EPP-362

Plasma Power Source

Service Manual

0558011929 **01/2015**

BE SURE THIS INFORMATION REACHES THE OPERATOR.
YOU CAN GET EXTRA COPIES THROUGH YOUR SUPPLIER.

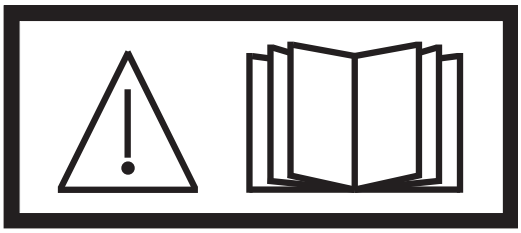
⚠ CAUTION

These INSTRUCTIONS are for experienced operators. If you are not fully familiar with the principles of operation and safe practices for arc welding and cutting equipment, we urge you to read our booklet, "Precautions and Safe Practices for Arc Welding, Cutting, and Gouging," Form 52-529. Do NOT permit untrained persons to install, operate, or maintain this equipment. Do NOT attempt to install or operate this equipment until you have read and fully understand these instructions. If you do not fully understand these instructions, contact your supplier for further information. Be sure to read the Safety Precautions before installing or operating this equipment.

USER RESPONSIBILITY

This equipment will perform in conformity with the description thereof contained in this manual and accompanying labels and/or inserts when installed, operated, maintained and repaired in accordance with the instructions provided. This equipment must be checked periodically. Malfunctioning or poorly maintained equipment should not be used. Parts that are broken, missing, worn, distorted or contaminated should be replaced immediately. Should such repair or replacement become necessary, the manufacturer recommends that a telephone or written request for service advice be made to the Authorized Distributor from whom it was purchased.

This equipment or any of its parts should not be altered without the prior written approval of the manufacturer. The user of this equipment shall have the sole responsibility for any malfunction which results from improper use, faulty maintenance, damage, improper repair or alteration by anyone other than the manufacturer or a service facility designated by the manufacturer.



READ AND UNDERSTAND THE INSTRUCTION MANUAL BEFORE INSTALLING OR OPERATING.

PROTECT YOURSELF AND OTHERS!

EPP-362 Plasma Power Source

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Safety - English

WARNING: These Safety Precautions are for your protection. They summarize precautionary information from the references listed in Additional Safety Information section. Before performing any installation or operating procedures, be sure to read and follow the safety precautions listed below as well as all other manuals, material safety data sheets, labels, etc. Failure to observe Safety Precautions can result in injury or death.

PROTECT YOURSELF AND OTHERS -- Some welding, cutting, and gouging processes are noisy and require ear protection. The arc, like the sun, emits ultraviolet (UV) and other radiation and can injure skin and eyes. Hot metal can cause burns. Training in the proper use of the processes and equipment is essential to prevent accidents. Therefore:

1. **Always wear safety glasses with side shields in any work area, even if welding helmets, face shields, and goggles are also required.**
2. **Use a face shield fitted with the correct filter and cover plates to protect your eyes, face, neck, and ears from sparks and rays of the arc when operating or observing operations. Warn bystanders not to watch the arc and not to expose themselves to the rays of the electric-arc or hot metal.**
3. **Wear flameproof gauntlet type gloves, heavy long-sleeve shirt, cuffless trousers, high-topped shoes, and a welding helmet or cap for hair protection, to protect against arc rays and hot sparks or hot metal. A flameproof apron may also be desirable as protection against radiated heat and sparks.**
4. **Hot sparks or metal can lodge in rolled up sleeves, trouser cuffs, or pockets. Sleeves and collars should be kept buttoned, and open pockets eliminated from the front of clothing.**
5. **Protect other personnel from arc rays and hot sparks with a suitable non-flammable partition or curtains.**
6. **Use goggles over safety glasses when chipping slag or grinding. Chipped slag may be hot and can fly far. Bystanders should also wear goggles over safety glasses.**

FIRES AND EXPLOSIONS -- Heat from flames and arcs can start fires. Hot slag or sparks can also cause fires and explosions. Therefore:

1. **Remove all combustible materials well away from the work area or cover the materials with a protective non-flammable covering. Combustible materials include wood, cloth, sawdust, liquid and gas fuels, solvents, paints and coatings, paper, etc.**
2. **Hot sparks or hot metal can fall through cracks or crevices in floors or wall openings and cause a hidden smoldering fire or fires on the floor below. Make certain that such openings are protected from hot sparks and metal."**
3. **Do not weld, cut or perform other hot work until the work piece has been completely cleaned so that there are no substances on the work piece which might produce flammable or toxic vapors. Do not do hot work on closed containers. They may explode.**
4. **Have fire extinguishing equipment handy for instant use, such as a garden hose, water pail, sand bucket, or portable fire extinguisher. Be sure you are trained in its use.**
5. **Do not use equipment beyond its ratings. For example, overloaded welding cable can overheat and create a fire hazard.**
6. **After completing operations, inspect the work area to make certain there are no hot sparks or hot metal which could cause a later fire. Use fire watchers when necessary.**
7. **For additional information, refer to NFPA Standard 51B, "Fire Prevention in Use of Cutting and Welding Processes", available from the National Fire Protection Association, Battery march Park, Quincy, MA 02269.**

ELECTRICAL SHOCK -- Contact with live electrical parts and ground can cause severe injury or death. DO NOT use AC welding current in damp areas, if movement is confined, or if there is danger of falling.

1. Be sure the power source frame (chassis) is connected to the ground system of the input power.

2. Connect the work piece to a good electrical ground.

3. Connect the work cable to the work piece. A poor or missing connection can expose you or others to a fatal shock.

4. Use well-maintained equipment. Replace worn or damaged cables.

5. Keep everything dry, including clothing, work area, cables, torch/electrode holder, and power source.

6. Make sure that all parts of your body are insulated from work and from ground.

7. Do not stand directly on metal or the earth while working in tight quarters or a damp area; stand on dry boards or an insulating platform and wear rubber-soled shoes.

8. Put on dry, hole-free gloves before turning on the power.

9. Turn off the power before removing your gloves.

10. Refer to ANSI/ASC Standard Z49.1 (listed on next page) for specific grounding recommendations. Do not mistake the work lead for a ground cable.

ELECTRIC AND MAGNETIC FIELDS — May be dangerous. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding and cutting current creates EMF around welding cables and welding machines. Therefore:

1. Welders having pacemakers should consult their physician before welding. EMF may interfere with some pacemakers.

2. Exposure to EMF may have other health effects which are unknown.

3. Welders should use the following procedures to minimize exposure to EMF:

   A. Route the electrode and work cables together. Secure them with tape when possible.

   B. Never coil the torch or work cable around your body.

   C. Do not place your body between the torch and work cables. Route cables on the same side of your body.

   D. Connect the work cable to the work piece as close as possible to the area being welded.

   E. Keep welding power source and cables as far away from your body as possible.

FUMES AND GASES -- Fumes and gases, can cause discomfort or harm, particularly in confined spaces. Do not breathe fumes and gases. Shielding gases can cause asphyxiation. Therefore:

1. Always provide adequate ventilation in the work area by natural or mechanical means. Do not weld, cut, or gouge on materials such as galvanized steel, stainless steel, copper, zinc, lead, beryllium, or cadmium unless positive mechanical ventilation is provided. Do not breathe fumes from these materials.

2. Do not operate near degreasing and spraying operations. The heat or arc rays can react with chlorinated hydrocarbon vapors to form phosgene, a highly toxic gas, and other irritant gases.

3. If you develop momentary eye, nose, or throat irritation while operating, this is an indication that ventilation is not adequate. Stop work and take necessary steps to improve ventilation in the work area. Do not continue to operate if physical discomfort persists.

4. Refer to ANSI/ASC Standard Z49.1 (see listing below) for specific ventilation recommendations.

5. **WARNING: This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety Code §25249.5 et seq.)**

CYLINDER HANDLING -- Cylinders, if mishandled, can rupture and violently release gas. Sudden rupture of cylinder, valve, or relief device can injure or kill. Therefore:

1. Use the proper gas for the process and use the proper pressure reducing regulator designed to operate from the compressed gas cylinder. Do not use adaptors. Maintain hoses and fittings in good condition. Follow manufacturer's operating instructions for mounting regulator to a compressed gas cylinder.

2. Always secure cylinders in an upright position by chain or strap to suitable hand trucks, undercarriages, benches, walls, post, or racks. Never secure cylinders to work tables or fixtures where they may become part of an electrical circuit.

3. When not in use, keep cylinder valves closed. Have valve protection cap in place if regulator is not connected. Secure and move cylinders by using suitable hand trucks. Avoid rough handling of cylinders.

4. Locate cylinders away from heat, sparks, and flames. Never strike an arc on a cylinder.

5. For additional information, refer to CGA Standard P-1, "Precautions for Safe Handling of Compressed Gases in Cylinders", which is available from Compressed Gas Association, 1235 Jefferson Davis Highway, Arlington, VA 22202.

EQUIPMENT MAINTENANCE -- Faulty or improperly maintained equipment can cause injury or death. Therefore:

1. Always have qualified personnel perform the installation, troubleshooting, and maintenance work. Do not perform any electrical work unless you are qualified to perform such work.

2. Before performing any maintenance work inside a power source, disconnect the power source from the incoming electrical power.

3. Maintain cables, grounding wire, connections, power cord, and power supply in safe working order. Do not operate any equipment in faulty condition.

4. Do not abuse any equipment or accessories. Keep equipment away from heat sources such as furnaces, wet conditions such as water puddles, oil or grease, corrosive atmospheres and inclement weather.

5. Keep all safety devices and cabinet covers in position and in good repair.

6. Use equipment only for its intended purpose. Do not modify it in any manner.

ADDITIONAL SAFETY INFORMATION -- For more information on safe practices for electric arc welding and cutting equipment, ask your supplier for a copy of "Precautions and Safe Practices for Arc Welding, Cutting and Gouging", Form 52-529.

The following publications, which are available from the American Welding Society, 550 N.W. LeJuene Road, Miami, FL 33126, are recommended to you:

1. ANSI/ASC Z49.1 - "Safety in Welding and Cutting".
2. AWS C5.1 - "Recommended Practices for Plasma Arc Welding".
3. AWS C5.2 - "Recommended Practices for Plasma Arc Cutting".
4. AWS C5.3 - "Recommended Practices for Air Carbon Arc Gouging and Cutting".
5. AWS C5.5 - "Recommended Practices for Gas Tungsten Arc Welding".
6. AWS C5.6 - "Recommended Practices for Gas Metal Arc Welding".
7. AWS SP - "Safe Practices" - Reprint, Welding Handbook.
8. ANSI/AWS F4.1, "Recommended Safe Practices for Welding and Cutting of Containers That Have Held Hazardous Substances."
9. CSA Standard - W117.2 = Safety in Welding, Cutting and Allied Processes.

SAFETY

MEANING OF SYMBOLS - As used throughout this manual: Means Attention! Be Alert! Your safety is involved.

DANGER **Means immediate hazards which, if not avoided, will result in immediate, serious personal injury or loss of life.**

CAUTION **Means potential hazards which could result in personal injury or loss of life.**

WARNING **Means hazards which could result in minor personal injury.**

Enclosure Class

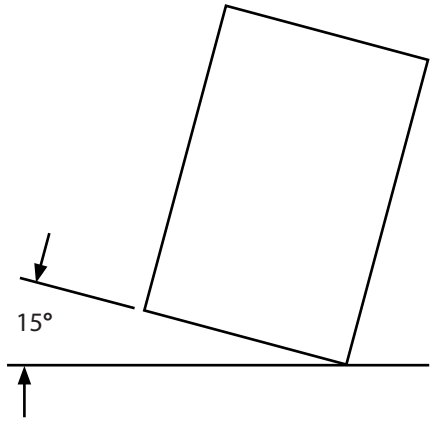
The **IP** code indicates the enclosure class, i.e. the degree of protection against penetration by solid objects or water. Protection is provided against touch with a finger, penetration of solid objects greater than 12mm and against spraying water up to 60 degrees from vertical. Equipment marked **IP21S** may be stored, but is not intended to be used outside during precipitation unless sheltered.

CAUTION

This product is solely intended for plasma cutting. Any other use may result in personal injury and / or equipment damage.

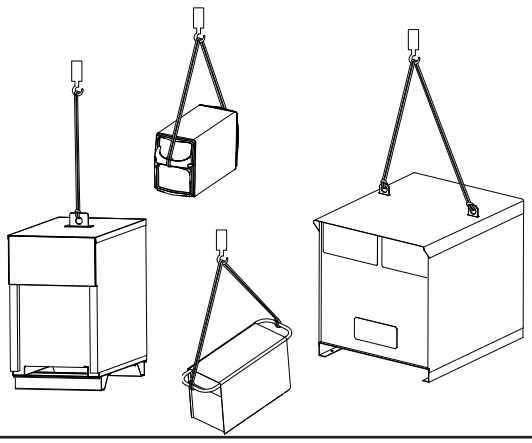
CAUTION

If equipment is placed on a surface that slopes more than 15°, toppling over may occur. Personal injury and / or significant damage to equipment is possible.



CAUTION

To avoid personal injury and/or equipment damage, lift using method and attachment points shown here.



Safety - Spanish

ADVERTENCIA: Estas Precauciones de Seguridad son para su protección. Ellas hacen resumen de información proveniente de las referencias listadas en la sección "Información Adicional Sobre La Seguridad". Antes de hacer cualquier instalación o procedimiento de operación , asegúrese de leer y seguir las precauciones de seguridad listadas a continuación así como también todo manual, hoja de datos de seguridad del material, calcomanias, etc. El no observar las Precauciones de Seguridad puede resultar en daño a la persona o muerte.

PROTEJASE USTED Y A LOS DEMAS-- Algunos procesos de soldadura, corte y ranurado son ruidosos y requiren protección para los oídos. El arco, como el sol , emite rayos ultravioleta (UV) y otras radiaciones que pueden dañar la piel y los ojos. El metal caliente causa quemaduras. EL entrenamiento en el uso propio de los equipos y sus procesos es esencial para prevenir accidentes. Por lo tanto:

1. Utilice gafas de seguridad con protección a los lados siempre que esté en el área de trabajo, aún cuando esté usando careta de soldar, protector para su cara u otro tipo de protección.
2. Use una careta que tenga el filtro correcto y lente para proteger sus ojos, cara, cuello, y oídos de las chispas y rayos del arco cuando se esté operando y observando las operaciones. Alerte a todas las personas cercanas de no mirar el arco y no exponerse a los rayos del arco eléctrico o el metal fundido.
3. Use guantes de cuero a prueba de fuego, camisa pesada de mangas largas, pantalón de ruedo liso, zapato alto al tobillo, y careta de soldar con capucha para el pelo, para proteger el cuerpo de los rayos y chispas calientes provenientes del metal fundido. En ocaciones un delantal a prueba de fuego es necesario para protegerse del calor radiado y las chispas.
4. Chispas y partículas de metal caliente puede alojarse en las mangas enrolladas de la camisa , el ruedo del pantalón o los bolsillos. Mangas y cuellos deberán mantenerse abotonados, bolsillos al frente de la camisa deberán ser cerrados o eliminados.
5. Proteja a otras personas de los rayos del arco y chispas calientes con una cortina adecuada no-flamable como división.
6. Use careta protectora además de sus gafas de seguridad cuando esté removiendo escoria o puliendo.

La escoria puede estar caliente y desprenderse con velocidad. Personas cercanas deberán usar gafas de seguridad y careta protectora.

FUEGO Y EXPLOSIONES -- El calor de las flamas y el arco pueden ocacionar fuegos. Escoria caliente y las chispas pueden causar fuegos y explosiones. Por lo tanto:

1. Remueva todo material combustible lejos del área de trabajo o cubra los materiales con una cobija a prueba de fuego. Materiales combustibles incluyen madera, ropa, líquidos y gases flamables, solventes, pinturas, papel, etc.
2. Chispas y partículas de metal pueden introducirse en las grietas y agujeros de pisos y paredes causando fuegos escondidos en otros niveles o espacios. Asegúrese de que toda grieta y agujero esté cubierto para proteger lugares adyacentes contra fuegos.
3. No corte, suelde o haga cualquier otro trabajo relacionado hasta que la pieza de trabajo esté totalmente limpia y libre de substancias que puedan producir gases inflamables o vapores tóxicos. No trabaje dentro o fuera de contenedores o tanques cerrados. Estos pueden explotar si contienen vapores inflamables.
4. Tenga siempre a la mano equipo extintor de fuego para uso instantáneo, como por ejemplo una manguera con agua, cubeta con agua, cubeta con arena, o extintor portátil. Asegúrese que usted esta entrenado para su uso.
5. No use el equipo fuera de su rango de operación. Por ejemplo, el calor causado por cable sobrecarga en los cables de soldar pueden ocasionar un fuego.
6. Después de termirar la operación del equipo, inspeccione el área de trabajo para cerciorarse de que las chispas o metal caliente ocasionen un fuego más tarde. Tenga personal asignado para vigilar si es necesario.
7. Para información adicional , haga referencia a la publicación NFPA Standard 51B, "Fire Prevention in Use of Cutting and Welding Processes", disponible a través de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

CHOQUE ELECTRICO -- El contacto con las partes eléctricas energizadas y tierra puede causar daño severo o muerte. NO use soldadura de corriente alterna (AC) en áreas húmedas, de movimiento confinado en lugares estrechos o si hay posibilidad de caer al suelo.

1. Asegúrese de que el chasis de la fuente de poder esté conectado a tierra através del sistema de electricidad primario.
2. Conecte la pieza de trabajo a un buen sistema de tierra física.
3. Conecte el cable de retorno a la pieza de trabajo. Cables y conductores expuestos o con malas conexiones pueden exponer al operador u otras personas a un choque eléctrico fatal.
4. Use el equipo solamente si está en buenas condiciones. Reemplaze cables rotos, dañados o con conductores expuestos.
5. Mantenga todo seco, incluyendo su ropa, el área de trabajo, los cables, antorchas, pinza del electrodo, y la fuente de poder.
6. Asegúrese que todas las partes de su cuerpo están insuladas de ambos, la pieza de trabajo y tierra.
7. No se pare directamente sobre metal o tierra mientras trabaja en lugares estrechos o áreas húmedas; trabaje sobre un pedazo de madera seco o una plataforma insulada y use zapatos con suela de goma.
8. Use guantes secos y sin agujeros antes de energizar el equipo.
9. Apage el equipo antes de quitarse sus guantes.
10. Use como referencia la publicación ANSI/ASC Standard Z49.1 (listado en la próxima página) para recomendaciones específicas de como conectar el equipo a tierra. No confunda el cable de soldar a la pieza de trabajo con el cable a tierra.

CAMPOS ELECTRICOS Y MAGNETICOS - Son peligrosos. La corriente eléctrica fluye através de cualquier conductor causando a nivel local Campos Eléctricos y Magnéticos (EMF). Las corrientes en el área de corte y soldadura, crean EMF alrrededor de los cables de soldar y las maquinas. Por lo tanto:

1. Soldadores u Operadores que use marca-pasos para el corazón deberán consultar a su médico antes de soldar. El Campo Electromagnético (EMF) puede interferir con algunos marca-pasos.

2. Exponerse a campos electromagnéticos (EMF) puede causar otros efectos de salud aún desconocidos.

3. Los soldadores deberán usar los siguientes procedimientos para minimizar exponerse al EMF:

   A. Mantenga el electrodo y el cable a la pieza de trabajo juntos, hasta llegar a la pieza que usted quiere soldar. Asegúrelos uno junto al otro con cinta adhesiva cuando sea posible.
   B. Nunca envuelva los cables de soldar alrededor de su cuerpo.
   C. Nunca ubique su cuerpo entre la antorcha y el cable, a la pieza de trabajo. Mantega los cables a un sólo lado de su cuerpo.
   D. Conecte el cable de trabajo a la pieza de trabajo lo más cercano posible al área de la soldadura.
   E. Mantenga la fuente de poder y los cables de soldar lo más lejos posible de su cuerpo.

HUMO Y GASES -- El humo y los gases, pueden causar malestar o daño, particularmente en espacios sin ventilación. No inhale el humo o gases. El gas de protección puede causar falta de oxígeno.

Por lo tanto:

1. Siempre provea ventilación adecuada en el área de trabajo por medio natural o mecánico. No solde, corte, o ranure materiales con hierro galvanizado, acero inoxidable, cobre, zinc, plomo, berílio, o cadmio a menos que provea ventilación mecánica positiva . No respire los gases producidos por estos materiales.
2. No opere cerca de lugares donde se aplique substancias químicas en aerosol. El calor de los rayos del arco pueden reaccionar con los vapores de hidrocarburo clorinado para formar un fosfógeno, o gas tóxico, y otros irritant es.
3. Si momentáneamente desarrolla inrritación de ojos, nariz o garganta mientras est á operando, es indicación de que la ventilación no es apropiada. Pare de trabajar y tome las medidas necesarias para mejorar la ventilación en el área de trabajo. No continúe operando si el malestar físico persiste.
4. Haga referencia a la publicación ANSI/ASC Standard Z49.1 (Vea la lista a continuación) para recomendaciones específicas en la ventilación.

5. ADVERTENCIA-- Este producto cuando se utiliza para soldaduras o cortes, produce humos o gases, los cuales contienen químicos conocidos por el Estado de California de causar defectos en el nacimiento, o en algunos casos, Cancer. (California Health & Safety Code §25249.5 et seq.)

MANEJO DE CILINDROS-- Los cilindros, si no son manejados correctamente, pueden romperse y liberar violentamente gases. Rotura repentina del cilindro, válvula, o válvula de escape puede causar daño o muerte. Por lo tanto:

1. Utilize el gas apropiado para el proceso y utilize un regulador diseñado para operar y reducir la presión del cilindro de gas . No utilice adaptadores. Mantenga las mangueras y las conexiones en buenas condiciones. Observe las instrucciones de operación del manufacturero para montar el regulador en el cilindro de gas comprimido.

2. Asegure siempre los cilindros en posición vertical y amárrelos con una correa o cadena adecuada para asegurar el cilindro al carro, transportes, tablilleros, paredes, postes, o armazón. Nunca asegure los cilindros a la mesa de trabajo o las piezas que son parte del circuito de soldadura . Este puede ser parte del circuito elélectrico.

3. Cuando el cilindro no está en uso, mantenga la válvula del cilindro cerrada. Ponga el capote de protección sobre la válvula si el regulador no está conectado. Asegure y mueva los cilindros utilizando un carro o transporte adecuado. Evite el manejo brusco de los

MANTENIMIENTO DEL EQUIPO -- Equipo defectuoso o mal mantenido puede causar daño o muerte. Por lo tanto:

1. Siempre tenga personal cualificado para efectuar l a instalación, diagnóstico, y mantenimiento del equipo. No ejecute ningún trabajo eléctrico a menos que usted esté cualificado para hacer el trabajo.
2. Antes de dar mantenimiento en el interior de la fuente de poder, desconecte la fuente de poder del suministro de electricidad primaria.
3. Mantenga los cables, cable a tierra, conexciones, cable primario, y cualquier otra fuente de poder en buen estado operacional. No opere ningún equipo en malas condiciones.
4. No abuse del equipo y sus accesorios. Mantenga el equipo lejos de cosas que generen calor como hornos, también lugares húmedos como charcos de agua , aceite o grasa, atmósferas corrosivas y las inclemencias del tiempo.
5. Mantenga todos los artículos de seguridad y coverturas del equipo en su posición y en buenas condiciones.
6. Use el equipo sólo para el propósito que fue diseñado. No modifique el equipo en ninguna manera.

INFORMACION ADICIONAL DE SEGURIDAD -- Para

más información sobre las prácticas de seguridad de los equipos de arco eléctrico para soldar y cortar, pregunte a su suplidor por una copia de "Precautions and Safe Practices for Arc Welding, Cutting and Gouging-Form 52-529.

Las siguientes publicaciones, disponibles através de la American Welding Society, 550 N.W. LeJuene Road, Miami, FL 33126, son recomendadas para usted:

1. ANSI/ASC Z49.1 - "Safety in Welding and Cutting".
2. AWS C5.1 - "Recommended Practices for Plasma Arc Welding".
3. AWS C5.2 - "Recommended Practices for Plasma Arc Cutting".
4. AWS C5.3 - "Recommended Practices for Air Carbon Arc Gouging and Cutting".
5. AWS C5.5 - "Recommended Practices for Gas Tungsten Arc Welding".
6. AWS C5.6 - "Recommended Practices for Gas Metal Arc Welding".
7. AWS SP - "Safe Practices" - Reprint, Welding Handbook.
8. ANSI/AWS F4.1, "Recommended Safe Practices for Welding and Cutting of Containers That Have Held Hazardous Substances."
9. CSA Standard - W117.2 = Safety in Welding, Cutting and Allied Processes.

SIGNIFICADO DE LOS SIMBOLOS -- Según usted avanza en la lectura de este folleto: Los Símbolos Significan ¡Atención! ¡Esté Alerta! Se trata de su seguridad.

PELIGRO — **Significa riesgo inmediato que, de no ser evadido, puede resultar inmediatamente en serio daño personal o la muerte.**

ADVERTENCIA — **Significa el riesgo de un peligro potencial que puede resultar en serio daño personal o la muerte.**

CUIDADO — **Significa el posible riesgo que puede resultar en menores daños a la persona.**

Clase de envolvente

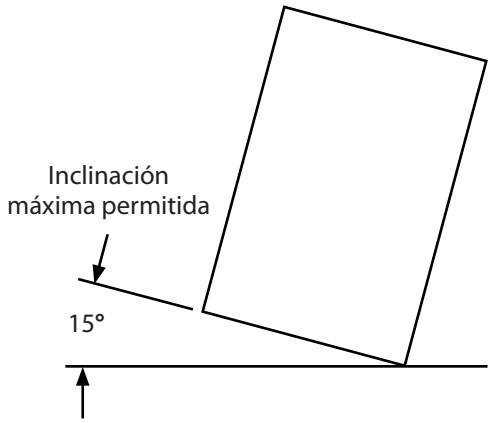
El código **IP** indica la clase de envolvente, es decir, el grado de protección contra la penetración de objetos sólidos o agua. Se provee protección contra el toque con un dedo, penetración de objetos sólidos de un tamaño superior a 12 mm y contra rocío de agua de hasta 60 grados de la vertical. El equipo marcado **IP21S** se puede almacenar, pero no se debe usar en el exterior durante periodos de precipitaciones a menos que esté protegido.

ADVERTENCIA

Este producto sólo se debe usar para corte por plasma Cualquier otro uso puede causar lesiones físicas y/o daños en los equipos.

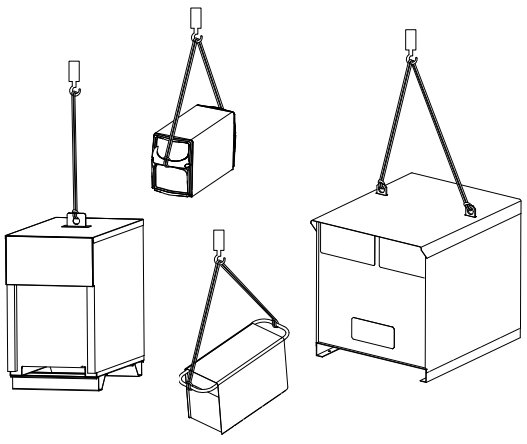
ADVERTENCIA

Si el equipo se coloca sobre una superficie con una inclinación superior a 15°, se puede producir un volcamiento. Es posible que se produzcan lesiones físicas y/o daños importantes en los equipos.



ADVERTENCIA

Para evitar lesiones físicas y/o daños en los equipos, levante mediante el método y los puntos de sujeción que se indican en esta ilustración.



Safety - French

AVERTISSEMENT : Ces règles de sécurité ont pour but d'assurer votre protection. Ils récapitulent les informations de précaution provenant des références dans la section des Informations de sécurité supplémentaires. Avant de procéder à l'installation ou d'utiliser l'unité, assurez-vous de lire et de suivre les précautions de sécurité ci-dessous, dans les manuels, les fiches d'information sur la sécurité du matériel et sur les étiquettes, etc. Tout défaut d'observer ces précautions de sécurité peut entraîner des blessures graves ou mortelles.

PROTÉGEZ-VOUS -- Les processus de soudage, de coupage et de gougeage produisent un niveau de bruit élevé et exige l'emploi d'une protection auditive. L'arc, tout comme le soleil, émet des rayons ultraviolets en plus d'autre rayons qui peuvent causer des blessures à la peau et les yeux. Le métal incandescent peut causer des brûlures. Une formation reliée à l'usage des processus et de l'équipement est essentielle pour prévenir les accidents. Par conséquent:

1. Portez des lunettes protectrices munies d'écrans latéraux lorsque vous êtes dans l'aire de travail, même si vous devez porter un casque de soudeur, un écran facial ou des lunettes étanches.
2. Portez un écran facial muni de verres filtrants et de plaques protectrices appropriées afin de protéger vos yeux, votre visage, votre cou et vos oreilles des étincelles et des rayons de l'arc lors d'une opération ou lorsque vous observez une opération. Avertissez les personnes se trouvant à proximité de ne pas regarder l'arc et de ne pas s'exposer aux rayons de l'arc électrique ou le métal incandescent.
3. Portez des gants ignifugiés à crispin, une chemise épaisse à manches longues, des pantalons sans rebord et des chaussures montantes afin de vous protéger des rayons de l'arc, des étincelles et du métal incandescent, en plus d'un casque de soudeur ou casquette pour protéger vos cheveux. Il est également recommandé de porter un tablier ininflammable afin de vous protéger des étincelles et de la chaleur par rayonnement.
4. Les étincelles et les projections de métal incandescent risquent de se loger dans les manches retroussées, les rebords de pantalons ou les poches. Il est recommandé de garder boutonnés le col et les manches et de porter des vêtements sans poches en avant.
5. Protégez toute personne se trouvant à proximité des étincelles et des rayons de l'arc à l'aide d'un rideau ou d'une cloison ininflammable.
6. Portez des lunettes étanches par dessus vos lunettes de sécurité lors des opérations d'écaillage ou de meulage du laitier. Les écailles de laitier incandescent peuvent être projetées à des distances considérables. Les personnes se trouvant à proximité doivent également porter des lunettes étanches par dessus leur lunettes de sécurité.

INCENDIES ET EXPLOSIONS -- La chaleur provenant des flammes ou de l'arc peut provoquer un incendie. Le laitier incandescent ou les étincelles peuvent également provoquer un incendie ou une explosion. Par conséquent :

1. Éloignez suffisamment tous les matériaux combustibles de l'aire de travail et recouvrez les matériaux avec un revêtement protecteur ininflammable. Les matériaux combustibles incluent le bois, les vêtements, la sciure, le gaz et les liquides combustibles, les solvants, les peintures et les revêtements, le papier, etc.
2. Les étincelles et les projections de métal incandescent peuvent tomber dans les fissures dans les planchers ou dans les ouvertures des murs et déclencher un incendie couvant à l'étage inférieur Assurez-vous que ces ouvertures sont bien protégées des étincelles et du métal incandescent.
3. N'exécutez pas de soudure, de coupe ou autre travail à chaud avant d'avoir complètement nettoyé la surface de la pièce à traiter de façon à ce qu'il n'ait aucune substance présente qui pourrait produire des vapeurs inflammables ou toxiques. N'exécutez pas de travail à chaud sur des contenants fermés car ces derniers pourraient exploser.
4. Assurez-vous qu'un équipement d'extinction d'incendie est disponible et prêt à servir, tel qu'un tuyau d'arrosage, un seau d'eau, un seau de sable ou un extincteur portatif. Assurez-vous d'être bien instruit par rapport à l'usage de cet équipement.
5. Assurez-vous de ne pas excéder la capacité de l'équipement. Par exemple, un câble de soudage surchargé peut surchauffer et provoquer un incendie.
6. Une fois les opérations terminées, inspectez l'aire de travail pour assurer qu'aucune étincelle ou projection de métal incandescent ne risque de provoquer un incendie ultérieurement. Employez des guetteurs d'incendie au besoin.
7. Pour obtenir des informations supplémentaires, consultez le NFPA Standard 51B, "Fire Prevention in Use of Cutting and Welding Processes", disponible au National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

CHOC ÉLECTRIQUE -- Le contact avec des pièces électriques ou les pièces de mise à la terre sous tension peut causer des blessures graves ou mortelles. NE PAS utiliser un courant de soudage c.a. dans un endroit humide, en espace restreint ou si un danger de chute se pose.

1. Assurez-vous que le châssis de la source d'alimentation est branché au système de mise à la terre de l'alimentation d'entrée.
2. Branchez la pièce à traiter à une bonne mise de terre électrique.
3. Branchez le câble de masse à la pièce à traiter et assurez une bonne connexion afin d'éviter le risque de choc électrique mortel.
4. Utilisez toujours un équipement correctement entretenu. Remplacez les câbles usés ou endommagés.
5. Veillez à garder votre environnement sec, incluant les vêtements, l'aire de travail, les câbles, le porte-électrode/torche et la source d'alimentation.
6. Assurez-vous que tout votre corps est bien isolé de la pièce à traiter et des pièces de la mise à la terre.
7. Si vous devez effectuer votre travail dans un espace restreint ou humide, ne tenez vous pas directement sur le métal ou sur la terre; tenez-vous sur des planches sèches ou une plate-forme isolée et portez des chaussures à semelles de caoutchouc.
8. Avant de mettre l'équipement sous tension, isolez vos mains avec des gants secs et sans trous.
9. Mettez l'équipement hors tension avant d'enlever vos gants.
10. Consultez ANSI/ASC Standard Z49.1 (listé à la page suivante) pour des recommandations spécifiques concernant les procédures de mise à la terre. Ne pas confondre le câble de masse avec le câble de mise à la terre.

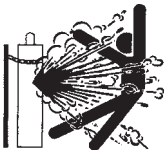
CHAMPS ÉLECTRIQUES ET MAGNÉTIQUES — comportent un risque de danger. Le courant électrique qui passe dans n'importe quel conducteur produit des champs électriques et magnétiques localisés. Le soudage et le courant de coupage créent des champs électriques et magnétiques autour des câbles de soudage et l'équipement. Par conséquent :

1. Un soudeur ayant un stimulateur cardiaque doit consulter son médecin avant d'entreprendre une opération de soudage. Les champs électriques et magnétiques peuvent causer des ennuis pour certains stimulateurs cardiaques.
2. L'exposition à des champs électriques et magnétiques peut avoir des effets néfastes inconnus pour la santé.
3. Les soudeurs doivent suivre les procédures suivantes pour minimiser l'exposition aux champs électriques et magnétiques :
   A. Acheminez l'électrode et les câbles de masse ensemble. Fixez-les à l'aide d'une bande adhésive lorsque possible.
   B. Ne jamais enrouler la torche ou le câble de masse autour de votre corps.
   C. Ne jamais vous placer entre la torche et les câbles de masse. Acheminez tous les câbles sur le même côté de votre corps.
   D. Branchez le câble de masse à la pièce à traiter le plus près possible de la section à souder.
   E. Veillez à garder la source d'alimentation pour le soudage et les câbles à une distance appropriée de votre corps.

LES VAPEURS ET LES GAZ -- peuvent causer un malaise ou des dommages corporels, plus particulièrement dans les espaces restreints. Ne respirez pas les vapeurs et les gaz. Le gaz de protection risque de causer l'asphyxie. Par conséquent :

1. Assurez en permanence une ventilation adéquate dans l'aire de travail en maintenant une ventilation naturelle ou à l'aide de moyens mécanique. N'effectuez jamais de travaux de soudage, de coupage ou de gougeage sur des matériaux tels que l'acier galvanisé, l'acier inoxydable, le cuivre, le zinc, le plomb, le berylliym ou le cadmium en l'absence de moyens mécaniques de ventilation efficaces. Ne respirez pas les vapeurs de ces matériaux.
2. N'effectuez jamais de travaux à proximité d'une opération de dégraissage ou de pulvérisation. Lorsque la chaleur
   ou le rayonnement de l'arc entre en contact avec les vapeurs d'hydrocarbure chloré, ceci peut déclencher la formation de phosgène ou d'autres gaz irritants, tous extrêmement toxiques.
3. Une irritation momentanée des yeux, du nez ou de la gorge au cours d'une opération indique que la ventilation n'est pas adéquate. Cessez votre travail afin de prendre les mesures nécessaires pour améliorer la ventilation dans l'aire de travail. Ne poursuivez pas l'opération si le malaise persiste.
4. Consultez ANSI/ASC Standard Z49.1 (à la page suivante) pour des recommandations spécifiques concernant la ventilation.

5. **AVERTISSEMENT : Ce produit, lorsqu'il est utilisé dans une opération de soudage ou de coupage, dégage des vapeurs ou des gaz contenant des chimiques considéres par l'état de la Californie comme étant une cause des malformations congénitales et dans certains cas, du cancer. (California Health & Safety Code §25249.5 et seq.)**



MANIPULATION DES CYLINDRES -- La manipulation d'un cylindre, sans observer les précautions nécessaires, peut produire des fissures et un échappement dangereux des gaz. Une brisure soudaine du cylindre, de la soupape ou du dispositif de surpression peut causer des blessures graves ou mortelles. Par conséquent :

1. Utilisez toujours le gaz prévu pour une opération et le détendeur approprié conçu pour utilisation sur les cylindres de gaz comprimé. N'utilisez jamais d'adaptateur. Maintenez en bon état les tuyaux et les raccords. Observez les instructions d'opération du fabricant pour assembler le détendeur sur un cylindre de gaz comprimé.
2. Fixez les cylindres dans une position verticale, à l'aide d'une chaîne ou une sangle, sur un chariot manuel, un châssis de roulement, un banc, un mur, une colonne ou un support convenable. Ne fixez jamais un cylindre à un poste de travail ou toute autre dispositif faisant partie d'un circuit électrique.
3. Lorsque les cylindres ne servent pas, gardez les soupapes fermées. Si le détendeur n'est pas branché, assurez-vous que le bouchon de protection de la soupape est bien en place. Fixez et déplacez les cylindres à l'aide d'un chariot manuel approprié. Toujours manipuler les cylindres avec soin.
4. Placez les cylindres à une distance appropriée de toute source de chaleur, des étincelles et des flammes. Ne jamais amorcer l'arc sur un cylindre.
5. Pour de l'information supplémentaire, consultez CGA Standard P-1, "Precautions for Safe Handling of Compressed Gases in Cylinders", mis à votre disposition par le Compressed Gas Association, 1235 Jefferson Davis Highway, Arlington, VA 22202.

ENTRETIEN DE L'ÉQUIPEMENT -- Un équipement entretenu de façon défectueuse ou inadéquate peut causer des blessures graves ou mortelles. Par conséquent :

1. Efforcez-vous de toujours confier les tâches d'installation, de dépannage et d'entretien à un personnel qualifié. N'effectuez aucune réparation électrique à moins d'être qualifié à cet effet.
2. Avant de procéder à une tâche d'entretien à l'intérieur de la source d'alimentation, débranchez l'alimentation électrique.
3. Maintenez les câbles, les fils de mise à la terre, les branchements, le cordon d'alimentation et la source d'alimentation en bon état. N'utilisez jamais un équipement s'il présente une défectuosité quelconque.
4. N'utilisez pas l'équipement de façon abusive. Gardez l'équipement à l'écart de toute source de chaleur, notamment des fours, de l'humidité, des flaques d'eau, de l'huile ou de la graisse, des atmosphères corrosives et des intempéries.
5. Laissez en place tous les dispositifs de sécurité et tous les panneaux de la console et maintenez-les en bon état.
6. Utilisez l'équipement conformément à son usage prévu et n'effectuez aucune modification.

INFORMATIONS SUPPLÉMENTAIRES RELATIVES À LA SÉCURITÉ -- Pour obtenir de l'information supplémentaire sur les règles de sécurité à observer pour l'équipement de soudage à l'arc électrique et le coupage, demandez un exemplaire du livret "Precautions and Safe Practices for Arc Welding, Cutting and Gouging", Form 52-529.

Les publications suivantes sont également recommandées et mises à votre disposition par l'American Welding Society, 550 N.W. LeJuene Road, Miami, FL 33126 :

1. ANSI/ASC Z49.1 - "Safety in Welding and Cutting".
2. AWS C5.1 - "Recommended Practices for Plasma Arc Welding".
3. AWS C5.2 - "Recommended Practices for Plasma Arc Cutting".
4. AWS C5.3 - "Recommended Practices for Air Carbon Arc Gouging and Cutting".
5. AWS C5.5 - "Recommended Practices for Gas Tungsten Arc Welding".
6. AWS C5.6 - "Recommended Practices for Gas Metal Arc Welding".
7. AWS SP - "Safe Practices" - Reprint, Welding Handbook.
8. ANSI/AWS F4.1, "Recommended Safe Practices for Welding and Cutting of Containers That Have Held Hazardous Substances."
9. CSA Standard - W117.2 = Safety in Welding, Cutting and Allied Processes.

SIGNIFICATION DES SYMBOLES

Ce symbole, utilisé partout dans ce manuel, signifie "Attention" ! Soyez vigilant ! Votre sécurité est en jeu.

DANGER — **Signifie un danger immédiat. La situation peut entraîner des blessures graves ou mortelles.**

AVERTISSEMENT — **Signifie un danger potentiel qui peut entraîner des blessures graves ou mortelles.**

ATTENTION — **Signifie un danger qui peut entraîner des blessures corporelles mineures.**

Classe de protection de l'enveloppe

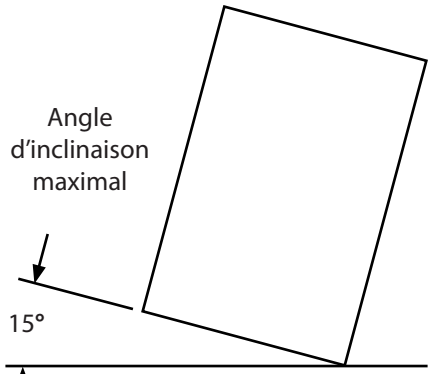
L'indice de protection (codification **IP**) indique la classe de protection de l'enveloppe, c'est-à-dire, le degré de protection contre les corps solides étrangers ou l'eau. L'enveloppe protège contre le toucher, la pénétration d'objets solides dont le diamètre dépasse 12 mm et contre l'eau pulvérisée à un angle de jusqu'à 60 degrés de la verticale. Les équipements portant la marque **IP21S** peuvent être entreposés à l'extérieur, mais ne sont pas conçus pour être utilisés à l'extérieur pendant une précipitation à moins d'être à l'abri.

AVERTISSEMENT

Ce produit a été conçu pour la découpe au plasma seulement. Toute autre utilisation pourrait causer des blessures et/ou endommager l'appareil.

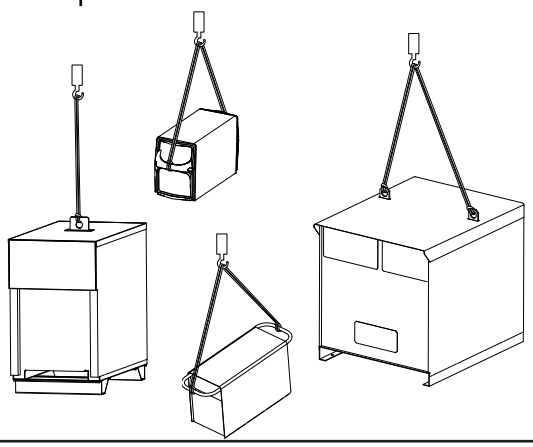
AVERTISSEMENT

L'équipement pourrait basculer s'il est placé sur une surface dont la pente dépasse 15°. Vous pourriez vous blesser ou endommager l'équipement de façon importante.



AVERTISSEMENT

Soulevez à l'aide de la méthode et des points d'attache illustrés afin d'éviter de vous blesser ou d'endommager l'équipement.



DANGER

When plasma cutting stainless steel, you must comply with the OSHA standard to protect your employees from Hexavalent Chromium exposure.

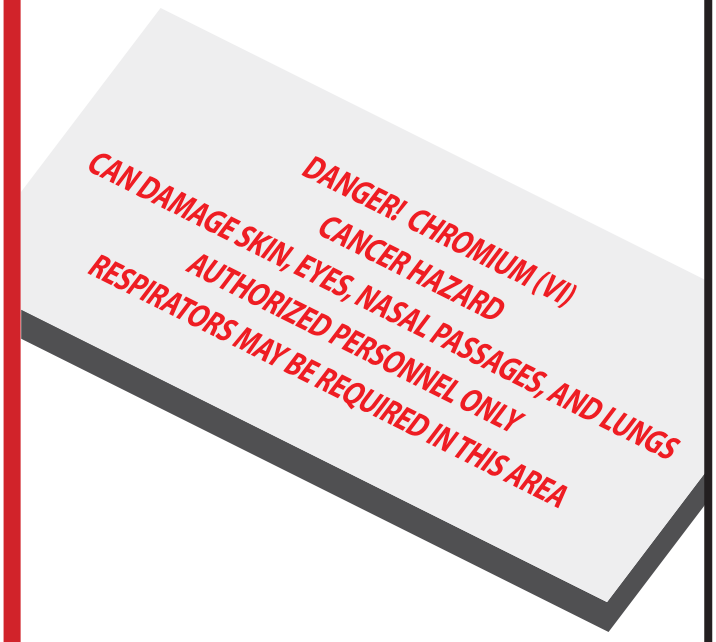
Engineering control must be used to reduce exposures to safe levels (in compliance with the new PEL). The specific details of the standard are complex and may require the assistance of an occupational health professional to reach full compliance

For additional information about Hexavalent Chromium contact your occupational health professional and read the OSHA web page at http://www.osha.gov/SLTC/hexavalentchromium/

CANCER HAZARD; CAN DAMAGE SKIN, EYES, NASAL PASSAGES, AND LUNGS; AUTHORIZED PERSONNEL ONLY; RESPIRATORS MAY BE REQUIRED.

CHROMIUM (VI)
Cr(VI)
HEXAVALENT CHROMIUM)

Hexavalent Chromium Cr(VI) is a toxic chemical component within fume and dust particles created in a variety of processes, including plasma cutting of stainless steel.



On February 28, 2006, the Occupational Safety and Health Agency (OSHA) published a revised standard to protect workers from the potential hazards of hexavalent chromium.

- Occupational exposure to hexavalent chromium (Cr(VI)) must be below the Permissible Exposure Limit (PEL) of 5 µg/m3 for an eight hour time weighted average.
- Workplace or job-specific monitoring must be done to establish areas of potential exposure and to quantify the potential exposure.
- Employees who may be exposed to levels of Cr(VI) at or above the new PEL must be informed and corrective measures implemented.
- Protective clothing and respiratory protection must be given to employees who have potential exposure.
- Medical surveillance of employees with potential exposure to Cr(VI) must be conducted.
- Areas of potential exposure to Cr(VI) must be indicated with warning signs containing the text shown at left.
- Engineering control must be used to reduce exposures to safe levels (in compliance with the new PEL). The specific details of the standard are complex and may require the assistance of an occupational health professional to reach full compliance

For additional information about Hexavalent Chromium contact your occupational health professional and read the OSHA web page at http://www.osha.gov/SLTC/hexavalentchromium/

INTRODUCTION

INTRODUCTION

Introduction

The purpose of this manual is to provide qualified repair personnel with technical information which will assist in trouble-shooting and repairing malfunctions.

General

The EPP-362 power source is designed for mechanized plasma cutting applications. It can be used with other ESAB products such as the PT-36 torch along with the m3 gas interface, a computerized gas regulation and switching system.

System features:

- 25 to 360 amperes cutting current range and as low as 10 for marking.
- 36 amp regulated pilot arc
- Forced air-cooled
- Water-Cooled IGBTs
- Internal Coolant Circulator
- Solid-state DC power
- Input voltage protection
- Thermal switch protection for IGBTs and input rectifier
- Top lifting rings or base forklift clearance for transport

Power Specifications

Part Number		EPP-362, 460V, 60Hz, 0558011314	EPP-362, 380V CCC, 50Hz, 0558011315	EPP-362, 400V CE, 50Hz, 0558011316	EPP-362, 575V, 60Hz, 0558011317
Output (100 % duty cycle)	Voltage	200 VDC			
	Current range DC (marking)	10A to 36A			
	Current range DC (cutting)	30A to 360A			
	Power	72KW			
	Open Circuit Voltage (OCV)	360 VDC	364 VDC	360 VDC	360 VDC
Input	Voltage (3-phase)	460 V	380 V	400 V	575 V
	Current (3- phase)	109 A RMS	134 A RMS	128 A RMS	92 A RMS
	Frequency	60 Hz	50 Hz	50 Hz	60 Hz
	KVA	88.7 KVA	88.5 KVA	88.6 KVA	91.6 KVA
	Power	83.7 KW	85.1 KW	84.7 KW	82.5 KW
	Power Factor	94%	96%	96%	90%
	Input Fuse (recommended)	150 A	175 A	175 A	125 A
Weight - lbs (kg)		1130 (514)	1130 (514)	1140 (518)	1130 (514)

INTRODUCTION

Service Manual Format

The "machine operation" flow diagram shows the breakdown of the functionality of the EPP-362. Each of the major components is divided into sections, which are described in the pages that follow. Each section in the flow chart has a matching section on the main schematic and is applied to the description pages. Each section starts with the schematic view with description, if the section includes a printed circuit PC board, it is followed by a PC board schematic, the layout of the board and then the component list for the board. Some PC boards will also have "mini descriptions" of selected circuits. This information is for troubleshooting purposes only, PC board repair is not recommended.

Circuit Description

The power circuit utilized in the EPP-362 is commonly referred to as a Chopper. High speed electronic switches turn on and off several thousand times per second providing pulses of power to the output. A filter circuit, consisting primarily of an inductor (sometimes called a choke), converts the pulses to a relatively constant DC (Direct Current) output.

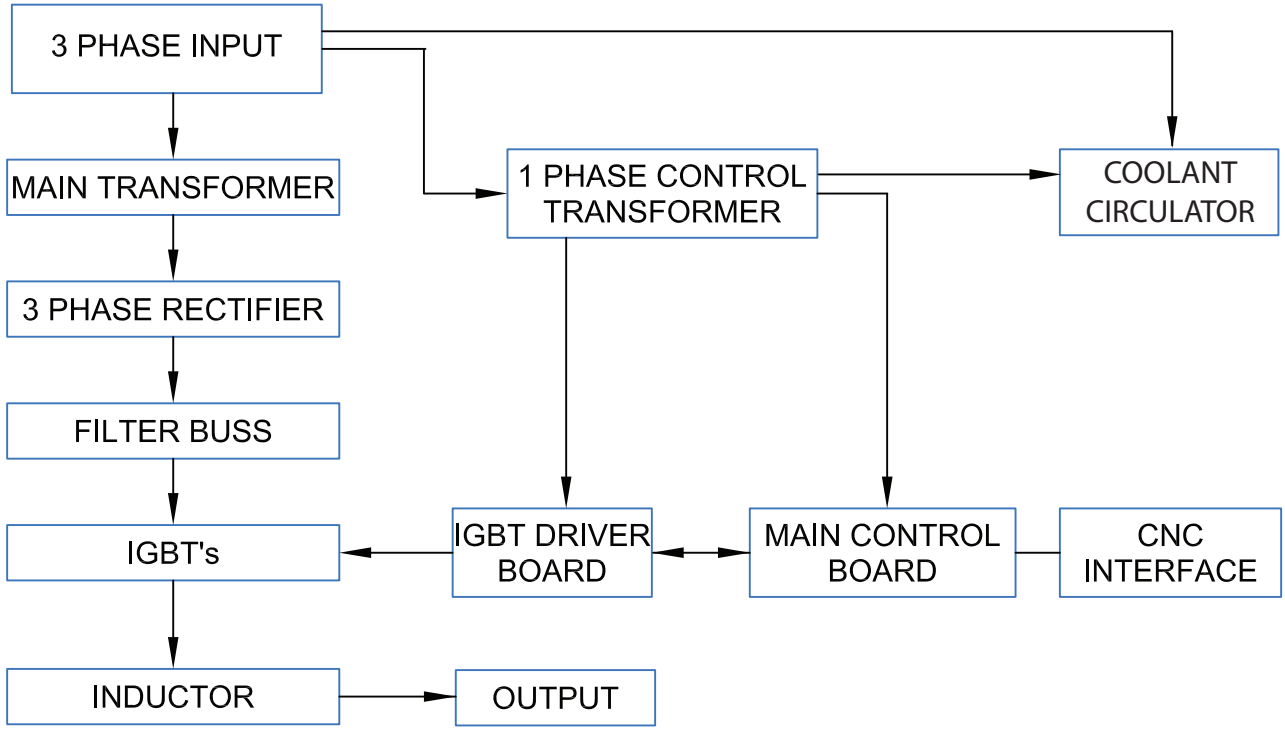
The EPP-362 Block Diagram shows the main functional elements of the power source. T1, the Main Transformer, provides isolation from the primary power line as well as the proper voltage for the 360V DC Bus. The Bus Rectifiers convert the three phase output of T1 to the 360V DC bus voltage. A capacitor bank provides filtering and energy storage that supplies power to the high speed electronic switches. These switches are known as IGBTs (Insulated Gate Bipolar Transistors). The IGBTs are the electronic switches that, in the EPP-362, turn on and off at a frequency ranging from 15 KHZ - 25 KHZ. They provide the pulses of power filtered by the inductor. The Free Wheeling Diodes provide the path for reverse current to flow when the IGBTs are off. The Hall Sensors are current transducers that monitor the output currents and provide the feedback signals for the control circuit.

Sequence of Events

The EPP-362 has no power switch installed in the unit. The wall breaker is the power disconnect for this power supply. Once the wall breaker is closed, the following events occur:

1. Power is applied to the control transformer T2. This supplies power to the circuit boards - PCB1 the Control board and PCB2 the Driver board. Main micro on the control board (PCB1) establishes the digital communication with CNC/Process Controller through CAN or analog interface through DB25 connector.
2. Pump Motor (M2) turns ON. Coolant pumps out to the torch and comes back into the tank through radiators, filter, flow sensor, and IGBTs cold plate respectively.
3. The Control board performs a fault/error check. If there are no faults/errors the power up sequence will continue.
4. Power Light (PL) on the front panel will be ON all time indicating there is input power available and Fault Light (FL) will be OFF indicating there are no faults/errors.
5. The power supply enable relay K4 will close if there are no errors/faults in the power source and there is no interruption in PS Enable chain on the cutting machine.
6. If above steps are satisfied then the Bus Pre-Charge contactor (K2) closes and charges the Bus Filter Capacitor (C1) through a 2-Ohm resistor in each phase.
7. Once bus is pre-charged to a threshold of 200 VDC then control baord issues the command to close the Main contactor (K1), Main Fan Motor (M1) and open K2. This will allow the bus filter capacitor to charge up to the full voltage of 360 VDC.
8. The bus will be high as soon as the wall breaker closed and there are no faults in the power supply. K1 and M1 will stay ON for 5 minutes of Idle operation and then they will turn OFF, hence bus filter capacitor voltage bleed through R8 (3 kOhm, 100W) resistor.

Machine Operation Flow Diagram



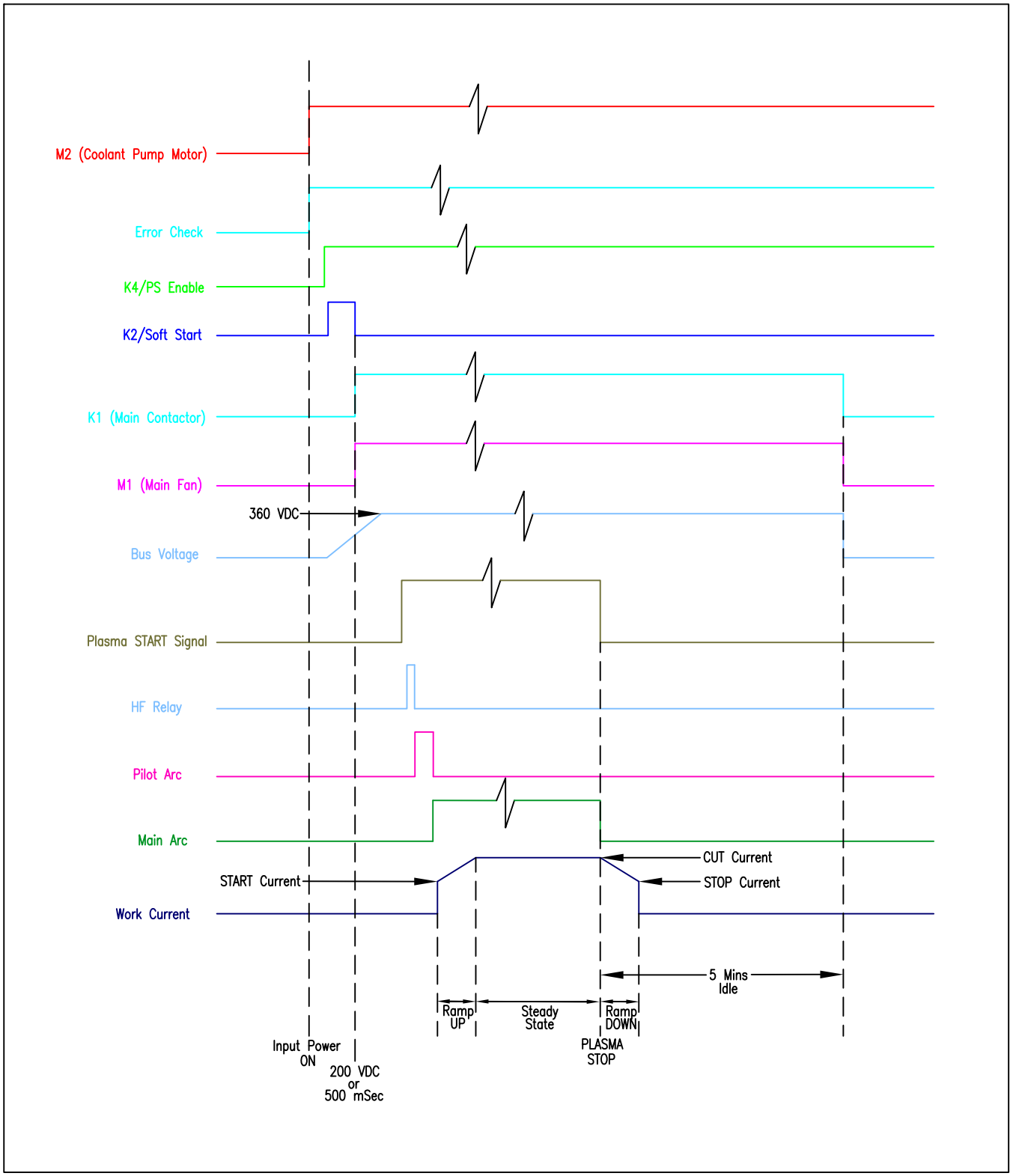
When the EPP-362 is commanded to start the plasma cut process, the following events occur:

1. Once a start signal is sent, if bus is not high, a soft start sequence begins. The main control board (PCB1) issues the command to close the bus pre-charger relay K2. This signal is sent to the Relay Block Module (RB1) through ribbon cable connector J6. On the relay block module relay one (RB1-1) is energized. This passes 24 VAC to the coil of K2, the soft start relay. This puts main line power to the Main Transformer (T1) with a 2 ohm resistor in series (with each phase) to initially limit the amount of current. This is done for two reasons:
    a. Due to the large input filter capacitors, a very large current would be seen on the output of the main transformer.
    b. To limit current in case there is a short on the rectifier, the capacitors, or the transformer.
2. After K2 is closed, PCB1 monitors the bus voltage across C1. The main-micro on PCB1 looks for bus filter capacitor voltage to reach +200 VDC or 500 ms time out. If +200 VDC is present, the micro initiates commands to pull in the main contactor K1, turn ON main fan (M1) and then open K2. After K1 is pulled in, the power supply waits few milliseconds for the bus to reach its full voltage of 360VDC. If bus filter capacitor voltage does not reach +200 VDC before 500 ms timer time out then power supply will send Error 15 to CNC/Process Controller via CAN and toggle the Fault Light (FL) on front panel with 50% duty cycle.
3. Once bus is fully charged and main-micro read all the respective currents and ramping times from CNC/Process Controller through CAN communication, main-micro will issue the PWM start signal to servo-micro which then will provide 25 KHZ frequency pulses to IGBTs. At this point main-micro monitors the Open Circuit Voltage (OCV) on the output, which should be at least 280 VDC for a period of 200 ms. If this fails then power supply will shutdown, toggles the fault light and sends Error 13 to the CNC/Process Controller.
4. If proper OCV is read main-micro sends command to close HF relay which will provide 115 VAC to HF circuit in the RAS box and sends pilot arc enable signal to servo-micro which then will provide PWM signal to pilot arc IGBT (Q5). If HF is present at the torch, Pilot Arc is established.

5. Once the Pilot Arc is established, if the torch is close enough to the work, and the work piece is grounded, Main Arc will transfer to work. Once main arc is established, which will be verified by sensing the work current through HS2 (work current greater than 5A), power supply will send the Arc ON signal to CNC/Process Controller via CAN and begins to ramp up current in accordance with the TDF file or the internal matrix.
6. After a cut is finished or stop signal is sent from the CNC/Process Controller, power supply ramps down the current according to TDF/SDP file, the fan stays ON and the K1 contactor remains closed for 5 minutes. If another start signal is sent prior to the 5 minutes time out, as the bus filter capacitor voltage will be at 360 VDC, power supply will not go through the soft start sequence.
7. After the 5 minutes timer timed out, main fan turns off and K1 opens. Now, if a start signal is sent, the EPP-362 will perform the sequence of operations - steps 1 through 6.

In case of MARKING, CNC/Process Controller will send the marking mode ON signal to power source via CAN Communication. Power source then closes RB1-5 relay to send 115 VAC to RAS box where the marking mode VDR ratio is selected for proper operation. The rest of operation is same as mentioned in steps 1 through 7 from the plasma unit.

Timing Diagram



INTRODUCTION

SCHEMATIC LAYOUT

SCHEMATIC LAYOUT

Schematic Layout

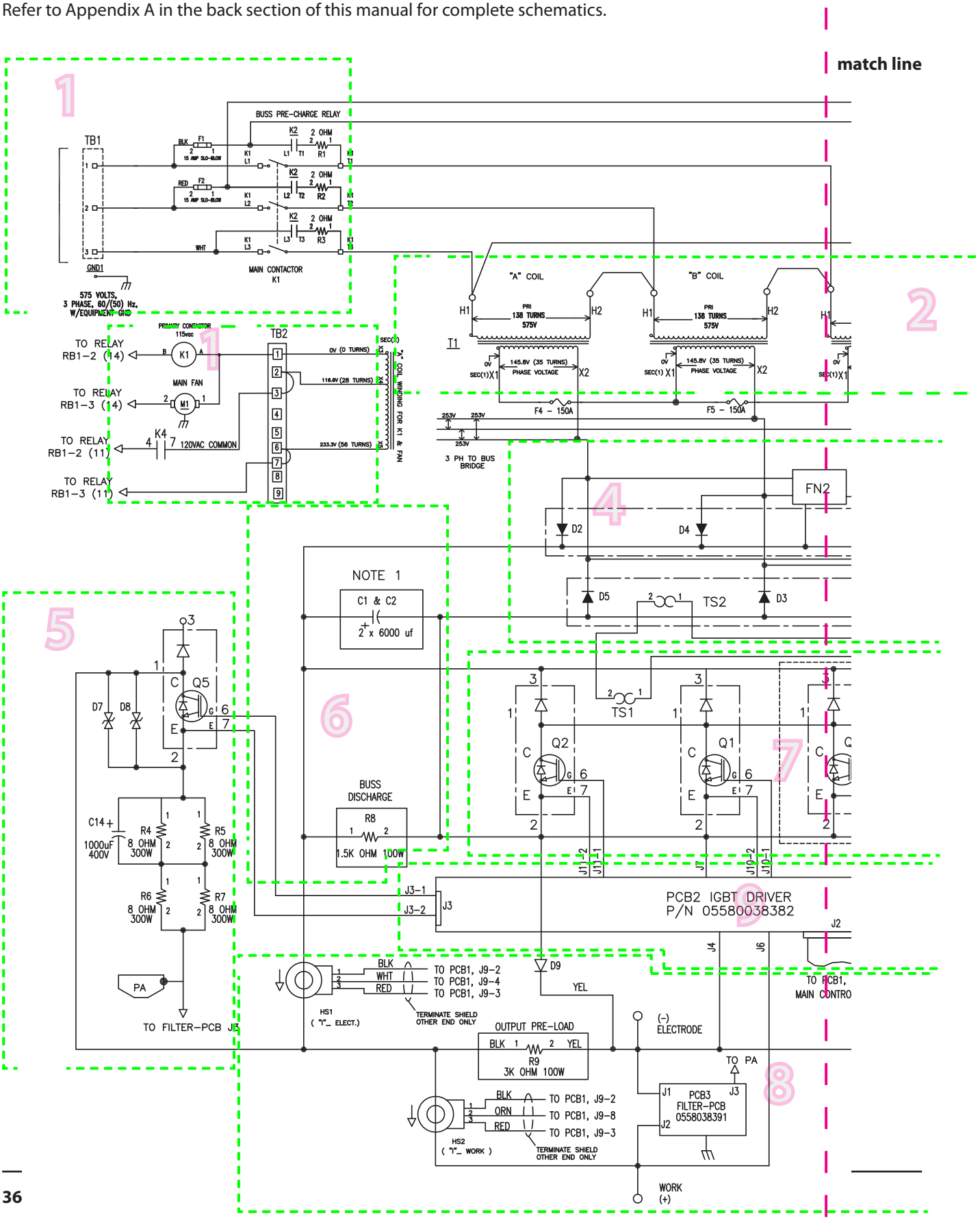
Component Locator

EPP-362 Components		
SYMBOL	**DESCRIPTION**	**Section 4.**
FL1	LARGE AMBER 12V PNL MT	3
PL1	LAMP WHITE 14V PNL MT	3
FS	SENSOR FLOW	12
D9	DIODE REVERSING 85A	8
M2	MOTOR COOLANT PUMP 1/2 HP	3
C14	CAPC 1000 MF 400 VDC W/NUT	5
C1	CAPC ELECT ALUM 6000 MF, 450V	6
R8	RES, 3 K OHM, 100 W, 5%	6
R9	RES 3K OHM, 100W, 5%	8
TB1	TERMINAL BLOCK 3 POS	1
TB2	TERM BLOCK 12 POS	1
TB3	TERMINAL BLOCK 18-POS	3
TB4	TERM BLOCK 7 POS 25A	3
TB5	TERMINAL BLOCK 9-POS	2
TB6	TERMINAL BLOCK 5-POS	3
R1, R2, R3	RES 2 OHM, 300W, 10%	1
R4,R5,R6,R7	RES 8 OHM, 300W, 10%	5
D1,3,5	DIODE REVERSE 300A 1200V	4
D2,4,6	DIODE FORWARD 300A 1200V	4
CB1	CIR BRKR 3 AMP	3
F1	FUSE, SLOW BLOW, 15 AMP	1
F2	FUSE, SLOW BLOW, 15 AMP	1
F3	FUSE 15A SLOW BLOW	3
HS1-2	SENSOR CURRENT	8
K1	CONTACTOR 3 POLE 150A	1
K2	CONTACTOR 3 POLE 40 AMP *24VAC	1
K4	RELAY ENCLOSE 3PDT *24VAC	1
K5	RELAY ENCLOSE 3PDT *24VAC	14
L1	INDUCTOR	9
M1	MOTOR 1/3 HP KO55NAL449	1
PCB1	PCB CONTROL/PGM'D	11
PCB2	PCB DRIVER BOARD	9
PCB3	PCB BOARD	8
Q1,2	IGBT 400A 1200V W/PLUG	7
Q5	IGBT 50A, 1200V	5
T1	FMR MAIN 400/460V	2
T2	FMR ASSY CONTROL	3
TS1	SW THML D/T 176 15A 120V	7
TS2	SWITCH THERMAL 194°F	4

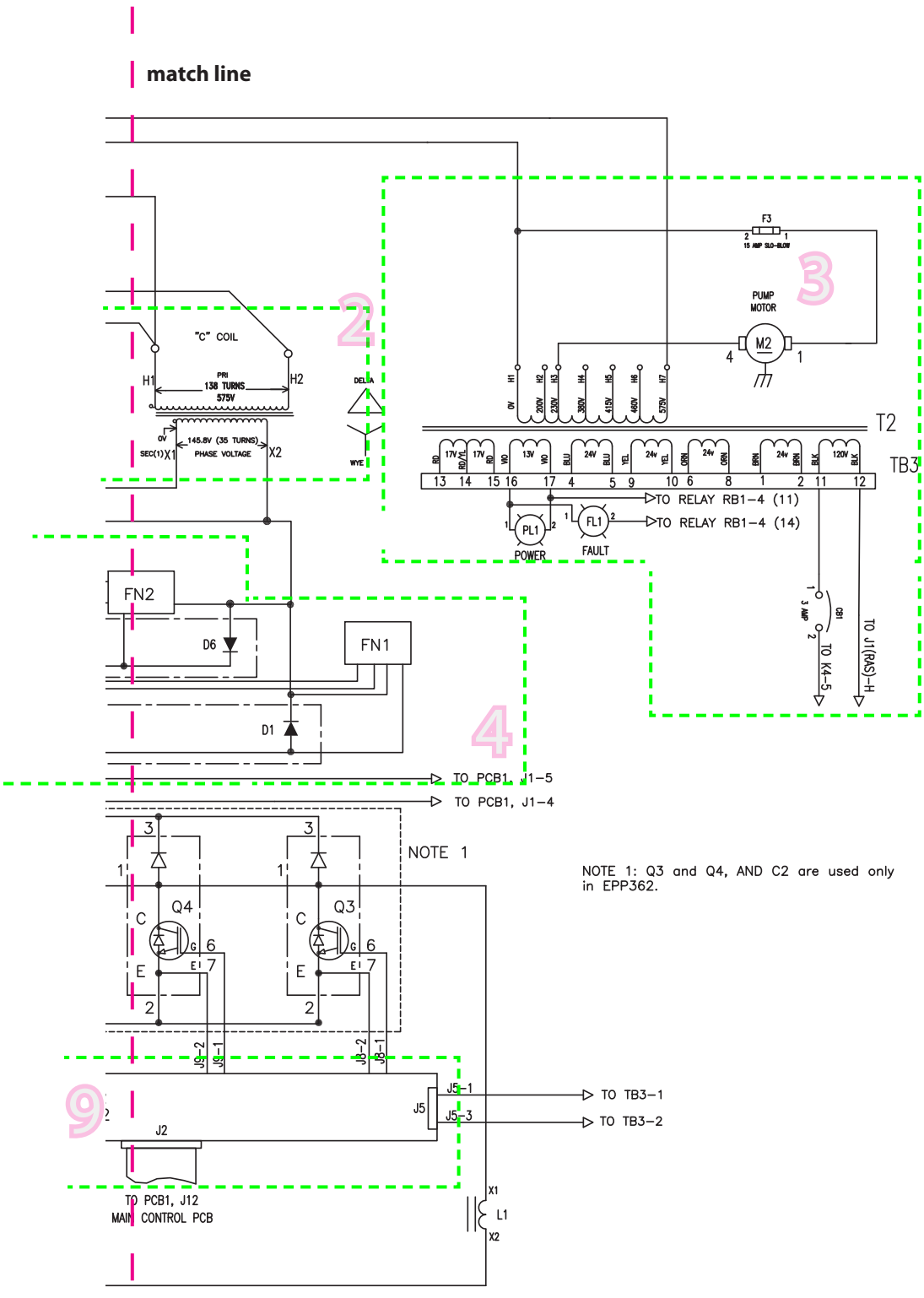
SCHEMATIC LAYOUT

Schematic Section Map - 0558010795

Refer to Appendix A in the back section of this manual for complete schematics.



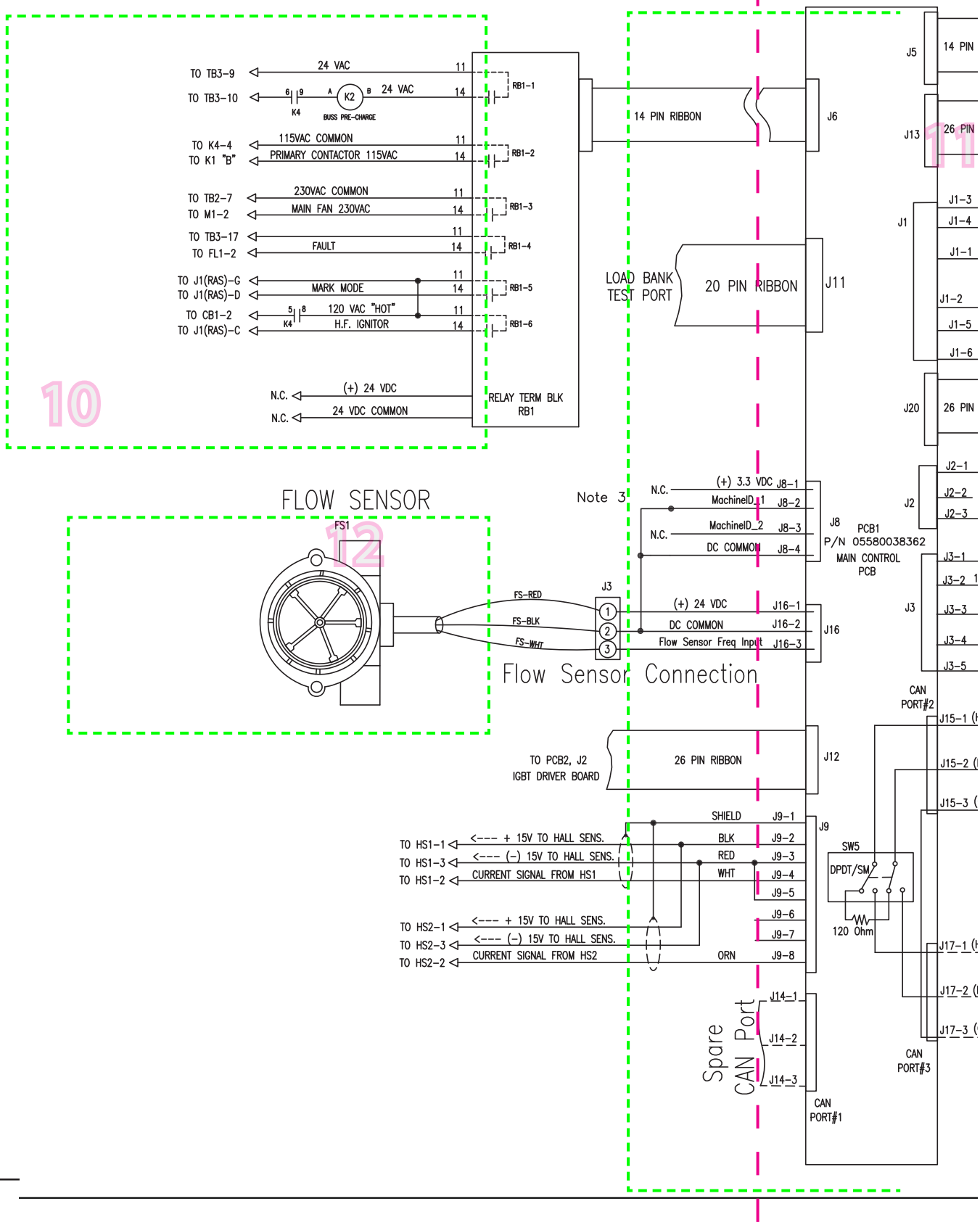
SCHEMATIC LAYOUT



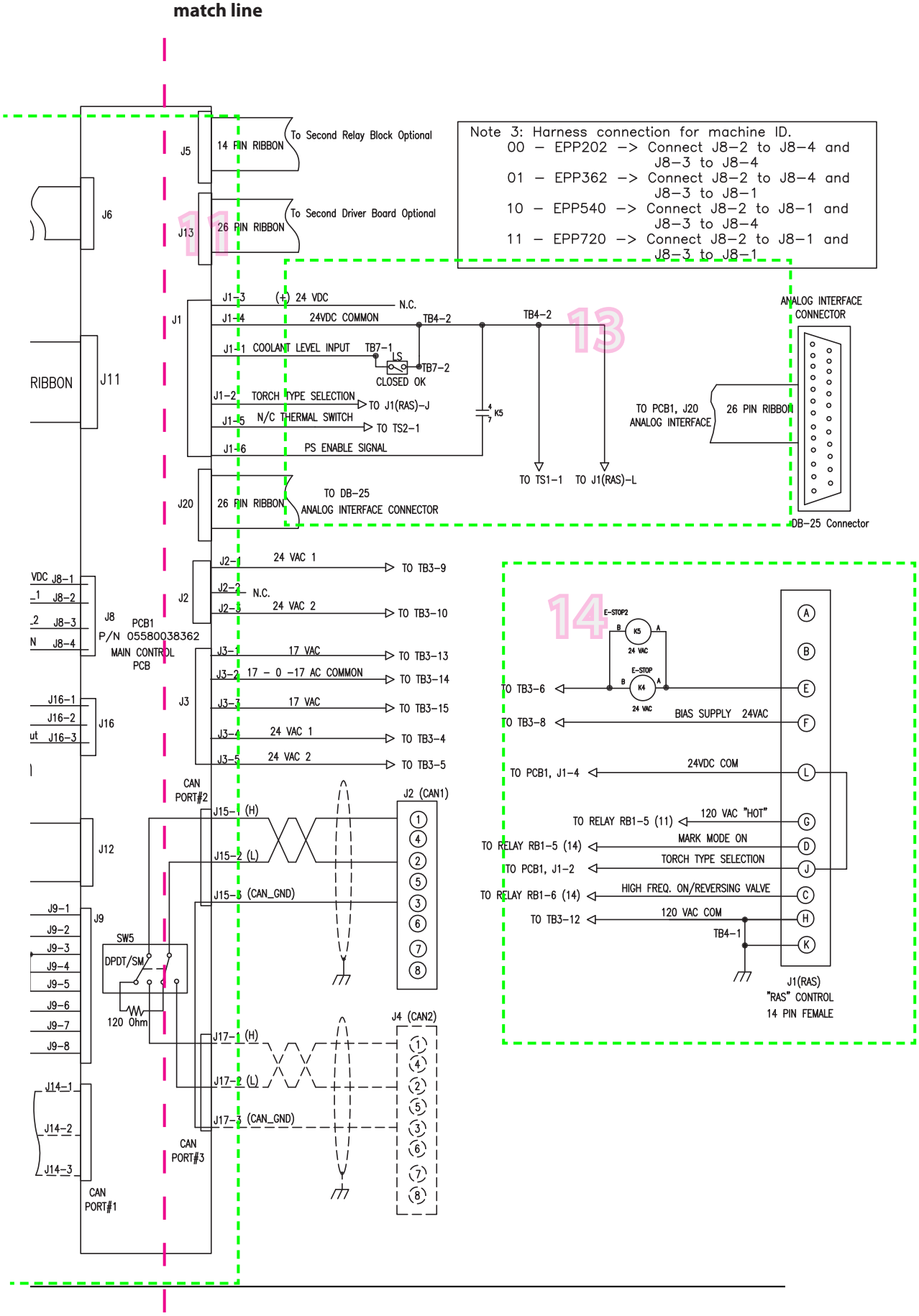
NOTE 1: Q3 and Q4, AND C2 are used only in EPP362.

Schematic Section Map - 0558010795, sheet 2

Refer to Appendix B in the back section of this manual for complete schematics.



SCHEMATIC LAYOUT



SCHEMATIC LAYOUT

DESCRIPTION of OPERATION

DESCRIPTION OF OPERATION

Relay Contactors

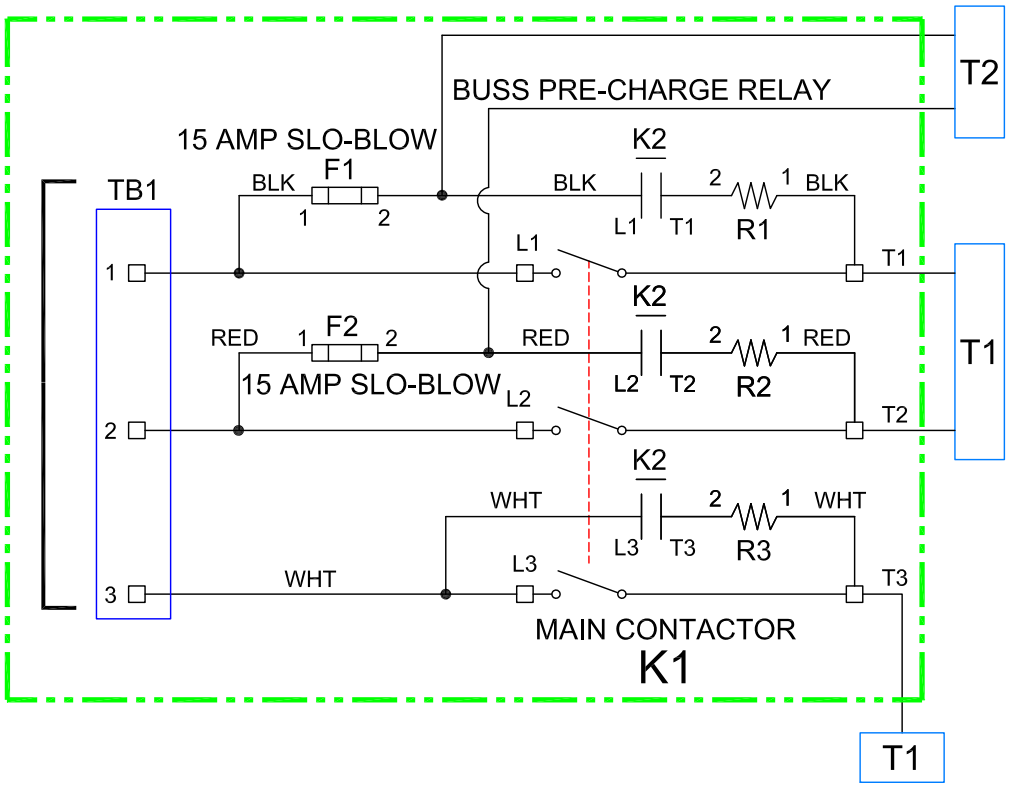
There are 4 contact relays installed in this power supply for proper operation. They are:

K1 Main Contactor – Connects the Line voltage directly to the main transformer.
K2 Soft Start – Connects the line voltage to the main transformer thru 2 ohm resistors for initial power up functions.
K4, K5 E-stop/PS enable and safety functions.

Main Contactor K1 (952251)

K1 is a 3 pole unit with 115 VAC coil. Two different power rating contactors are used in the family of EPP-362 power supplies. These are:

1. 3-pole, 150A, 115 VAC with P/N: 0558010712 used in 0558011310 machine.
2. 3-pole, 75A, 115 VAC with P/N: 0558010751 used in 0558011311, 0558011312, and 0558011313 machines.

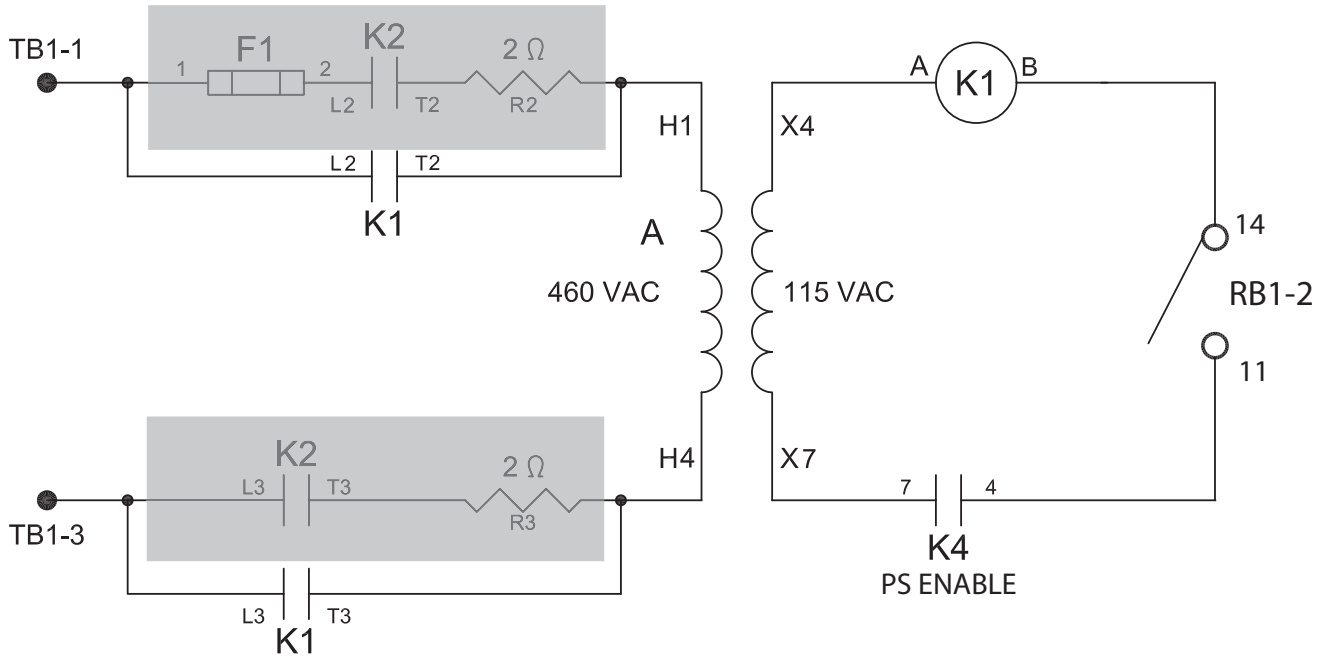


K1 Relay (Main Contactor Relay)

It is used as the main contactor relay for the EPP-202. Once the bus has reached 200 volts, the control board initiates turning on the main contactor and full bus voltage is developed at the filter caps. This connects main power to the main transformer after the main bus voltage has reached 200 VDC. See "Sequence of Events" in Introduction section for more information on this event.

K1 RELAY POWER PATH

The main contactor (K1) is energized by the Control Board (PCB1) when the filter bus reaches 200 VDC. The micro-controller monitors the bus voltage and during a start cycle when the bus reaches 200 VDC (in 500 ms or less) the control board issues a **Main Contactor Relay ON** signal to the relay terminal block through J6 pin 2 to close RB1-2 relay. The contacts of RB1-2 close which, in turn, provides 115 VAC to the K1 relay coil to close the contacts in order to connect the input power to main transformer. The 115 VAC signal originates from the main transformer (T1) coil "A" auxiliary winding X7 and is sent through a pair of PS Enable relay contacts K4, pins 7 and 4 and through RB1-2 relay contacts to K1B, and K1A is connected to X4 on TB2 to complete the 115 VAC circuit. See the diagram below:

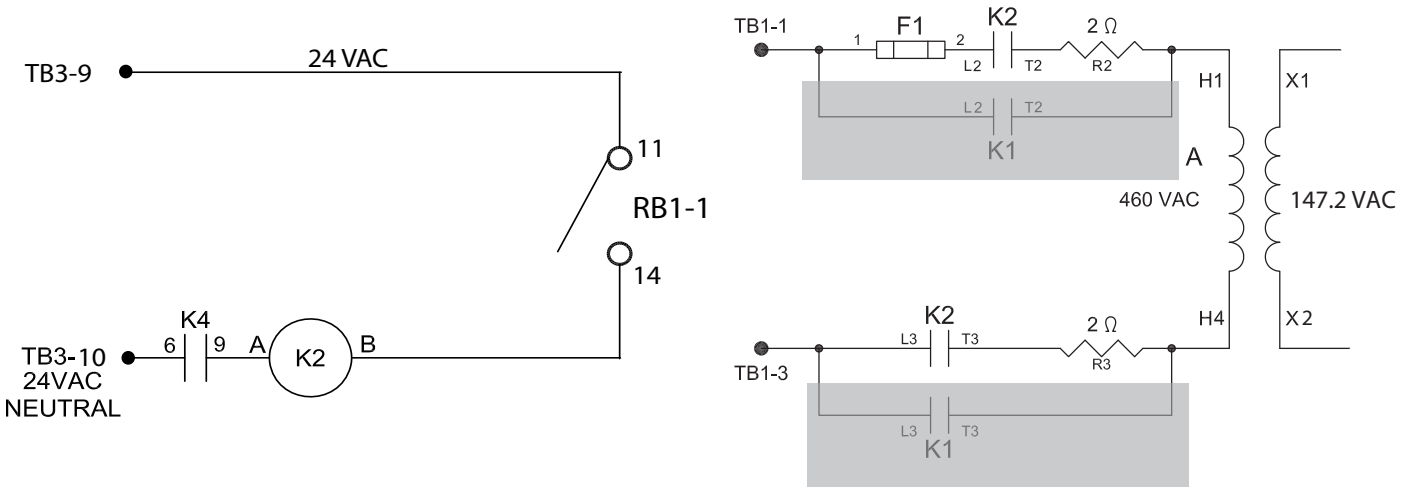


K2 Relay (Soft Start Relay)

K2 Relay (soft start Relay)
K2 is a 3 pole, 40 amp relay with a 24 VAC coil that has a resistance of 7.5 Ohms. It is used as the excitation or soft start relay for the power supply**.** When K2 closes, the bus is precharged through three 2 ohm resistors. This takes less than 500 ms and allows the bus to come up slowly. This prevents a surge of current through the rectifier diodes and the filter capacitors that would otherwise damage them.

Soft Start Circuit
The EPP-362 uses a Soft Start Circuit in order to precharge the bus before allowing the full current to be delivered to the input bridge and filter bus. In this way, initial current to the input rectifier and bus filter caps are limited so as to prevent an initial overload condition and damage these circuit components. The soft start circuit is composed of a pair of input fuses, three 2 Ohm resistors and the soft start contactor K2. When power source is powered up or a start command is issued if the machine is in idle state and if there are no errors in the power supply, the main control board closes the K2 relay. This allows the bus filter capacitors to charge at slower rate due to the 2 Ohm resistors restricting the initial current flow. When the bus filter capacitors reach 200 volts DC, the main control board sends the signal to close the main contactor K1 to allow the full current to be delivered to the input rectifier. If the bus filter does not reach 200 Volts DC in 500 milliseconds or less, the main control board halts the process and sends an error to the CNC.

K2 RELAY POWER PATH
The K2 bus charger or soft start contactor is energized when input breaker is closed or a start signal is issued from the CNC if the machine is in idle state and there are no errors/faults in the power source. The Control Board sends the **Bus Charger Relay ON** signal to the relay terminal block through J6 pin1 to close RB1-1 relay. The contacts of RB1-1 close which provide 24 VAC to K2 relay coil, which closes its contacts to charge the bus filter capacitor to 200 VDC. See diagram below:



K4, K5 Relay (PS Enable Relay) 0558007736

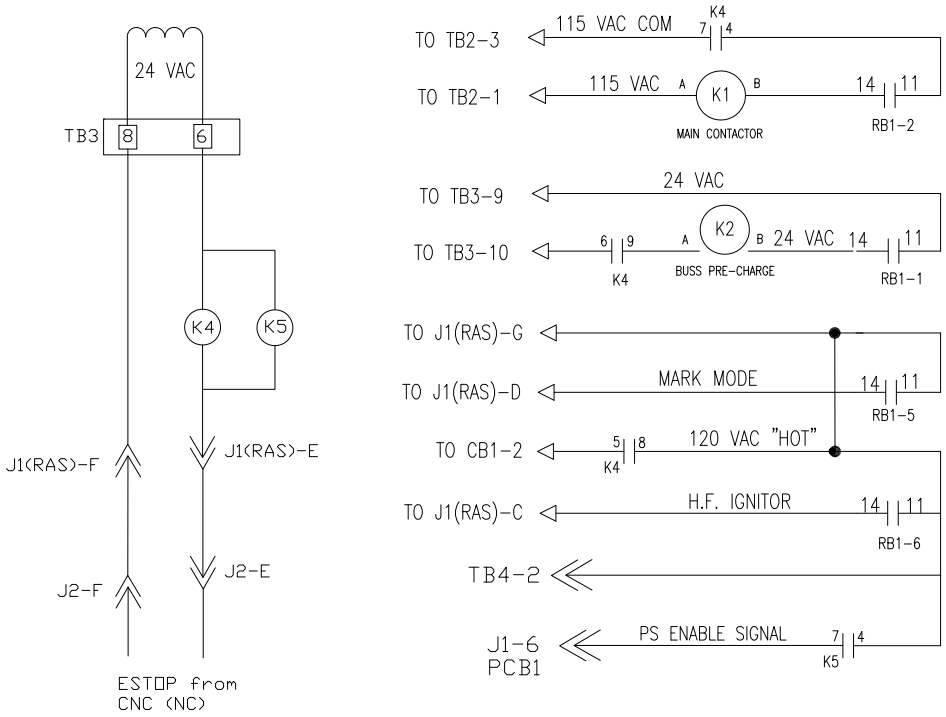
K4, K5 are enclosed double pole double throw 10 amp relays. K4 and K5 are connected in parallel to provide extra set of contacts. The coil is operated by 24 VAC and has a resistance of 75 ohms. This is the PS Enable relay, wired into the E-Stop circuit of the cutting machine. This relay opens for an E-stop event or interruption in controller enable signal.

K4, K5 Relay Power Path

These relays are energized when there is no emergency stop issues on the system. The K4, K5 relay coils are in series with the E-Stop circuits of the cutting machine. A break in the E-Stop chain removes power from the K4 and K5 coils. If the cutting machine E-Stop chain is broken the power supply will halt power output.

When K4 is de-energized it opens the three sets of contacts. These contacts provide power to the coil of K2, the soft start contactor, the second set of contacts is in the K1 power path, and third set of contacts provide 120 VAC to HF circuit in the RAS box when HF relay close command is issued from PCB1. With K4 open, no power reaches the main transformer T1. When K5 is de-energized, which happens simultaneously with K4, it opens one set of contacts which interupts PS Enables to PCB1. Should you attempt to start the EPP-202; the Control board will issue an error 23 indicating a fault.

The power path for the K4, K5 relay starts with 24 VAC from the control transformer T2 connected to TB3 pins 6 and 8. TB3 pin 6 is connected to K4 B. This then passes through the K4 coil and out terminal K4 A. From here, K4 A is connected to the chassis connector J1 pin E and routed out of the power supply to a set of E-Stop relay contacts of the cutting machine. This signal is then returned to the power supply on chassis connector J1 pin F, where is routed to TB3 pin 8 to complete the 24 VAC circuit. See the diagram below.



K4, K5 Relay (PS Enable Relay) 0558007736

DESCRIPTION:

COIL DATA: 50/60 HZ

VOLTAGE: 24 VAC

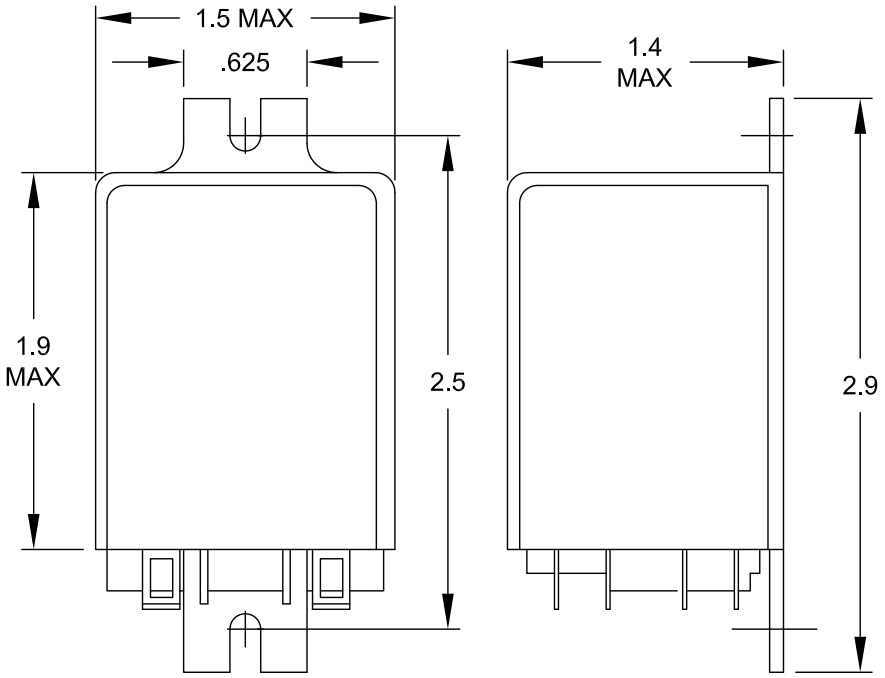
TEMP RANGE: -45°C TO +55°C(ENCLOSED)

TERMINATION: .187" QUICK CONNECT TABS

CONSTRUCTION: ENCLOSED BRACKET-MOUNTED

CONTACTS: 3PDT

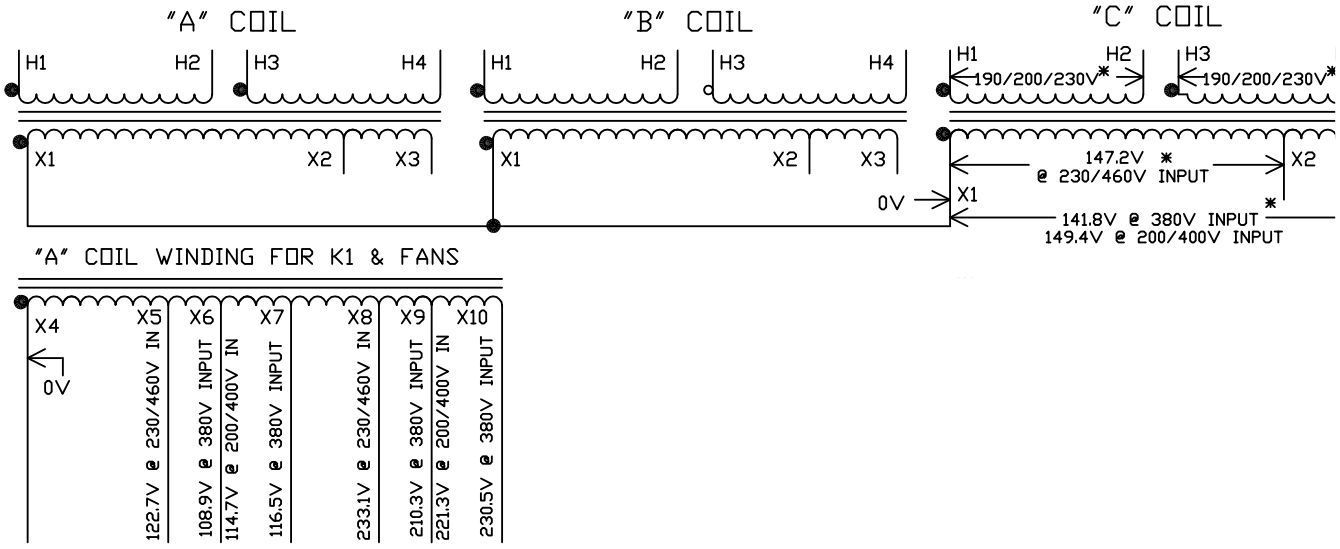
CONTACT DATA: 10A @ 240 VAC



Main Transformer T1

The Main Transformer T1 is a 3 phase transformer with a multi-tapped secondary. These come in 2 input voltage specifications: one is 200/230/380/400/460 VAC model, p/n 0558010746, the other is 575 VAC model, p/n 0558011717. There are three identical coils (A, B, and C). These Coils are configured using a Delta primary and a Wye secondary. The transformer is the source of high induction current, and it is the isolated secondary power distribution to the 360V bus. Due to it's size and weight, the transformer is mounted near the unit's center of gravity.

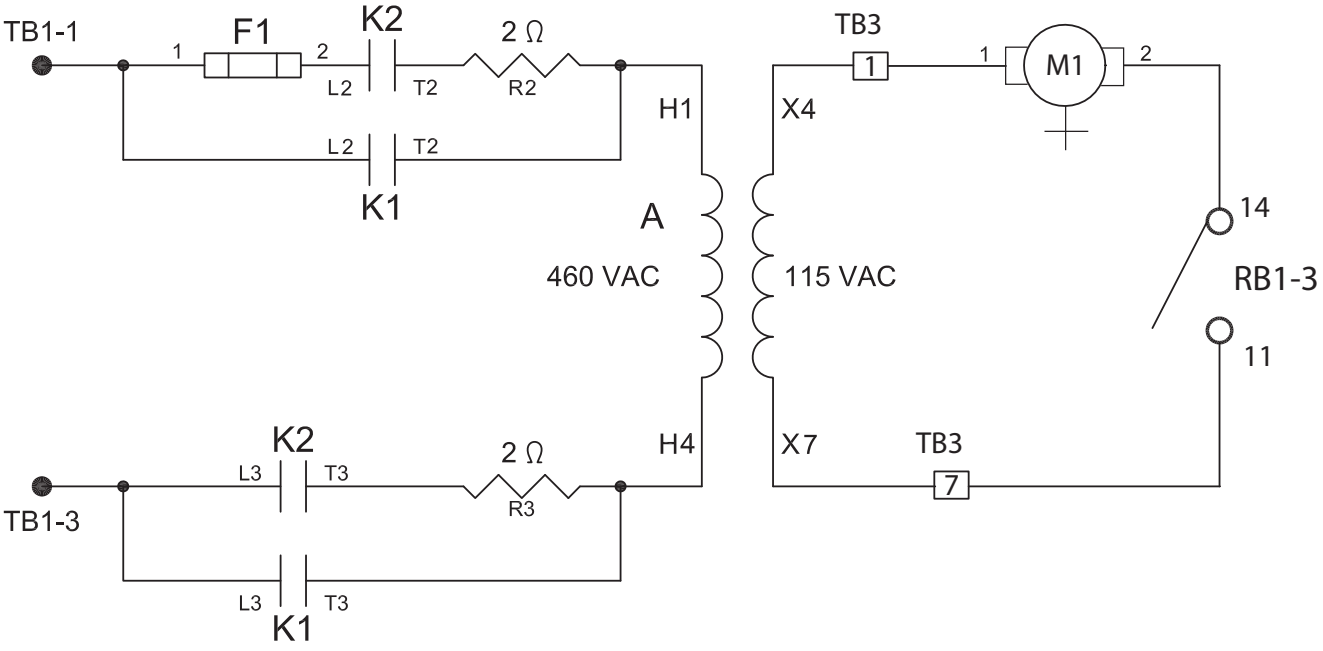
The secondary windings are connected in a Wye, which not only provides isolation from the primary power line, it also supplies the proper voltage for the 360 VDC bus. Additional windings are configured to produce step-down voltages for different load requirements.

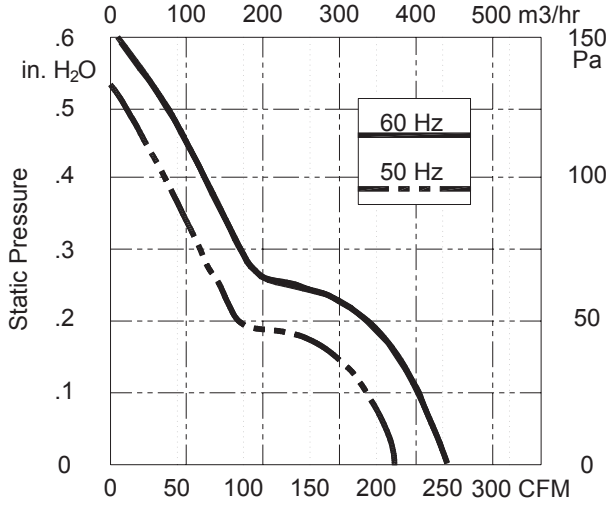


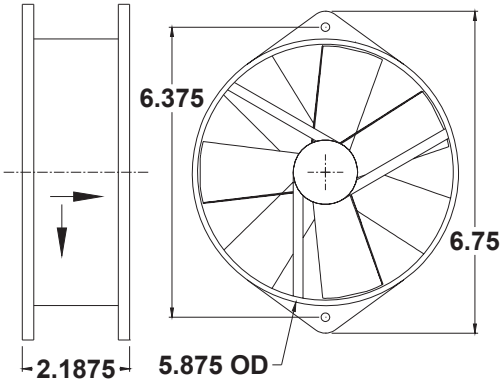
Fan Cooling

Fan Cooling of the EPP-362 is accomplished with one fan.

This fan, M1 (2062334) is a 230 VAC, 50/60 HZ, 1/3 horsepower motor rated at 2.8 (230 VAC) Amps. This unit is connected on one side to the X7 tap and the other side is connected to the RB1-3 for fan control. The X5 tap is the common return and is routed to PB1-3 for fan control. This fan provides air cooling for the EPP-362 across the lower end of the unit. The control board sends the main fan relay ON signal to the relay terminal block through J6 pin 3 which closes RB1-3 relay. See figure below.



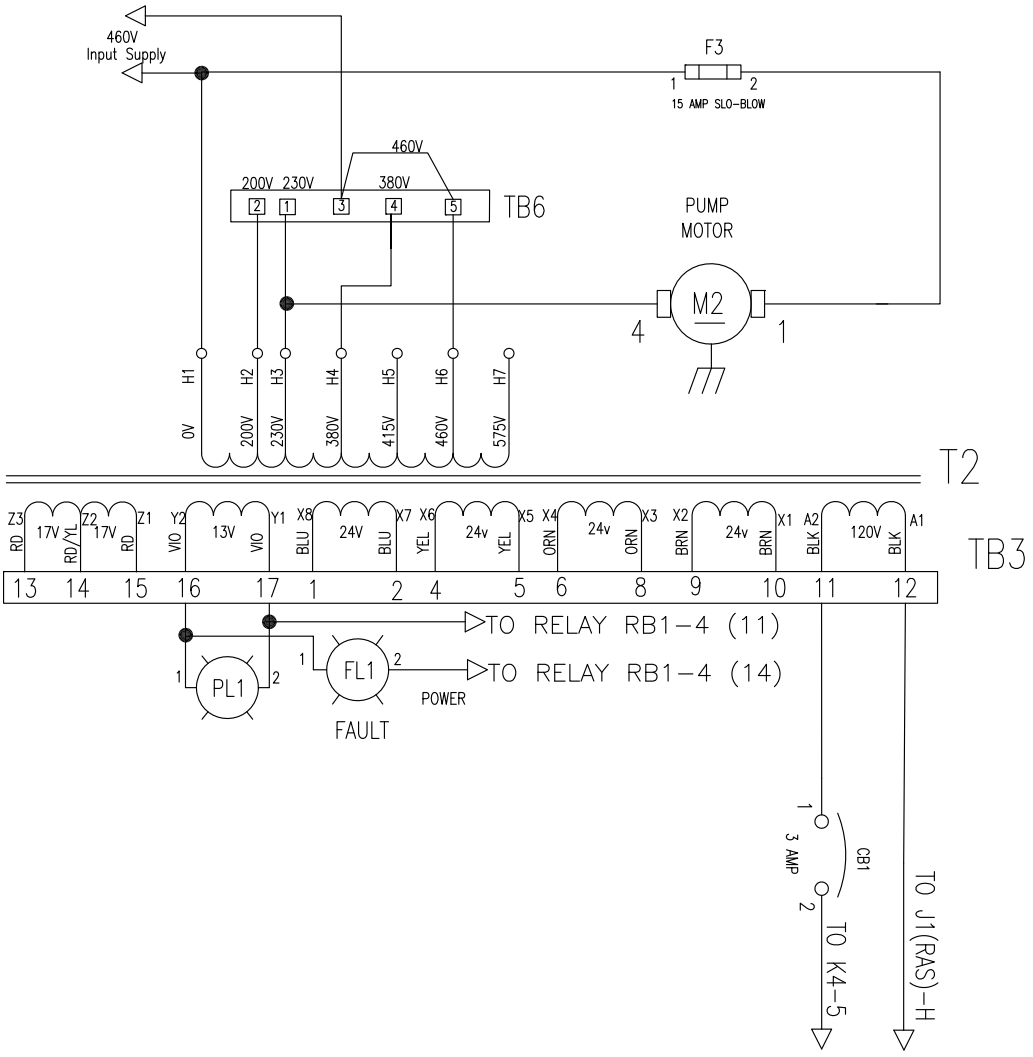




Control Transformer

The control transformer (T2) provides control voltages to various control relays on the chassis and PC boards of the EPP-362. This unit is instrumental in the power-up sequence providing the initial 120 VAC startup voltages and enabling the control relays to control the power supply.

T2 is designed to incorporate both auto-transformer and regular primary-secondary isolation transformer features. The auto-transformer operation of T2 is used to power the coolant pump motor. Half of the pump motor input current is drawn from T2 and half from the source/input wall supply. T2 has a multi tapped single phase primary that is connected to the line voltage supplied to the EPP-362. The primary can accept a variety of voltage inputs to accommodate the voltages in use by the customer. T2 has multiple secondary windings to supply various voltages to PCBs and relays. Reference the diagrams below.



Control Transformer Winding Outputs

- Secondary coil A1-A2 is 120 VAC, it provides signal to the HF circuit and Mark mode VDR selection inside the RAS box through relay block RB1, protected by a 3A circuit breaker “CB1”. Refer “Schematic Layout” section for detail schematics.

- Secondary coil X1-X2 is 24 VAC, provides power to Bus Charger Relay (K2) and Control board. On the control board this AC voltage connected to J2 pins 1 and 3 (PCB1) is rectified through diode bridge rectifier (D4, D18, D31, D34) to create 24 HVDC for isolated digital input signals connected to J1 (PCB1). Refer “Schematic Layout” section for detail schematics.

- Secondary coil X3-X4 is 24 VAC, provides power to PS Enable Relays (K4, K5). Refer “Schematic Layout” section for detail schematics.

- Secondary coil X5-X6 is 24 VAC, provides power to control board (PCB1) at J3 pins 4 and 5, which then rectified through diode bridge rectifier (D5, D6, D9, D10). Refer “Schematic Layout” section for detail schematics.

- Secondary coil X7-X8 is 24 VAC, provides power to driver board (PCB2) at J5 pins 1 and 3, which then rectified through diode bridge rectifier (D2, D3, D5, D6). Refer “Schematic Layout” section for detail schematics.

- Secondary coil Y1-Y2 is 13 VAC, provides power to power light (PL) and fault light (FL) which indicate the status of the power supply. Refer “Schematic Layout” section for detail schematics.

- Secondary coil Z1-Z2-Z3 is a center tapped 34 VAC, provides power to control board (PCB1) at J3 pins 1, 2 and 3 which then rectified through diode bridge rectifier (D7, D8, D11, D12). Refer “Schematic Layout” section for detail schematics.

Rectifier D1-D6

Input Rectifier
The input rectifier consists of six high current diodes configured to rectify the three phase input power delivered from the main transformer. Each phase has two diodes associated with it, one for the positive half cycle and one for the negative half cycle

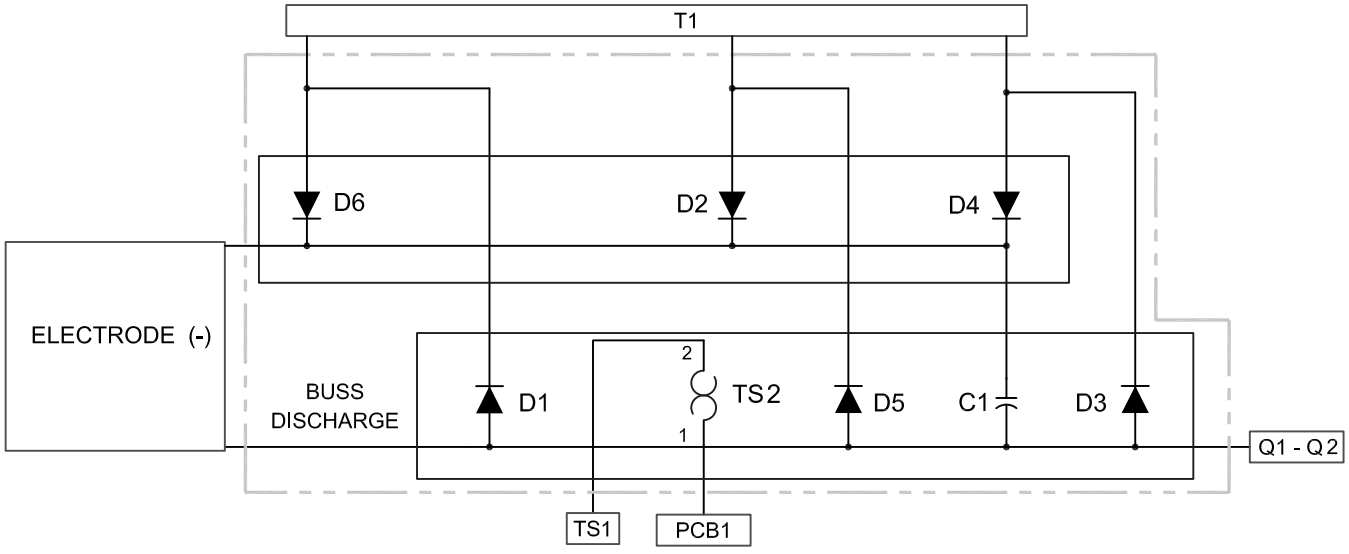
The input rectifiers convert the three phase output of T1 to the DC bus voltage. D1 thru D6 is a full wave rectifier with filter capacitor C1 used to reduce ripple.

D1, 3, and 5 0558003658 (Reverse)
D2, 4, and 6 0558003657 (Forward)
The input rectifier consists of 6 stud mount diode rectifiers. The output of this assembly is connected to the filter capacitor (C1) which supplies 360 VDC to the IGBTs.

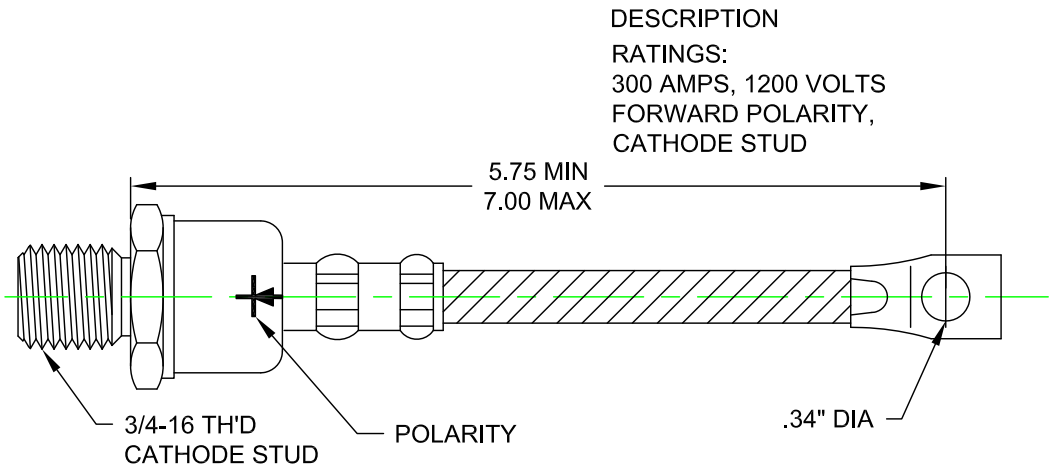
Testing:
D1, 3, and 5 0558003657
Forward Resistance 780 K Ohms
Reverse Resistance 5.5 M ohms

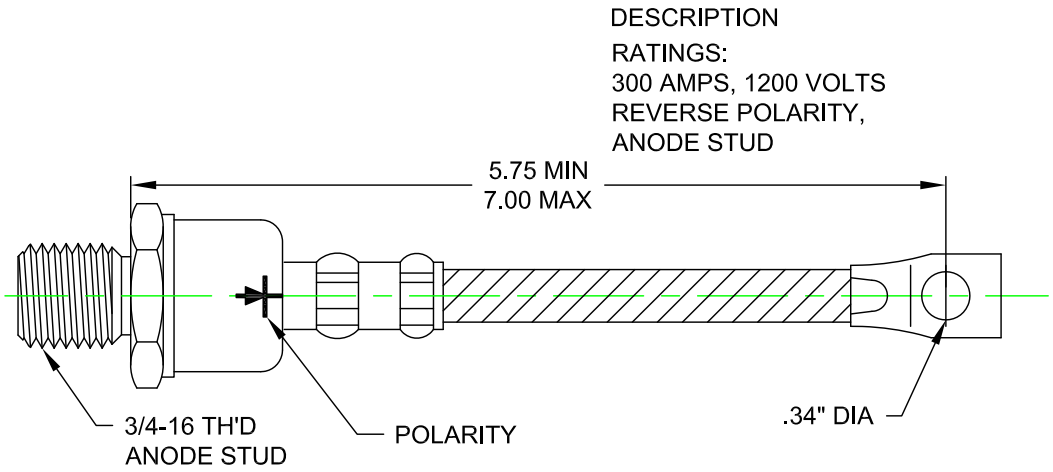
D2, 4, and 6 0558003658
Forward Resistance 660 K Ohms
Reverse Resistance 6 M Ohms

NOTE:
When replacing these diodes, new parts must be mounted to flat surfaces and torqued at 275 - 325 in-lbs. A conductive heat sink compound is required –Recommended: "Heat sink" Compound---Dow#340, ESAB part number 73585976



Input Rectifiers (0558003657_Forward - 0558003658_Reverse)

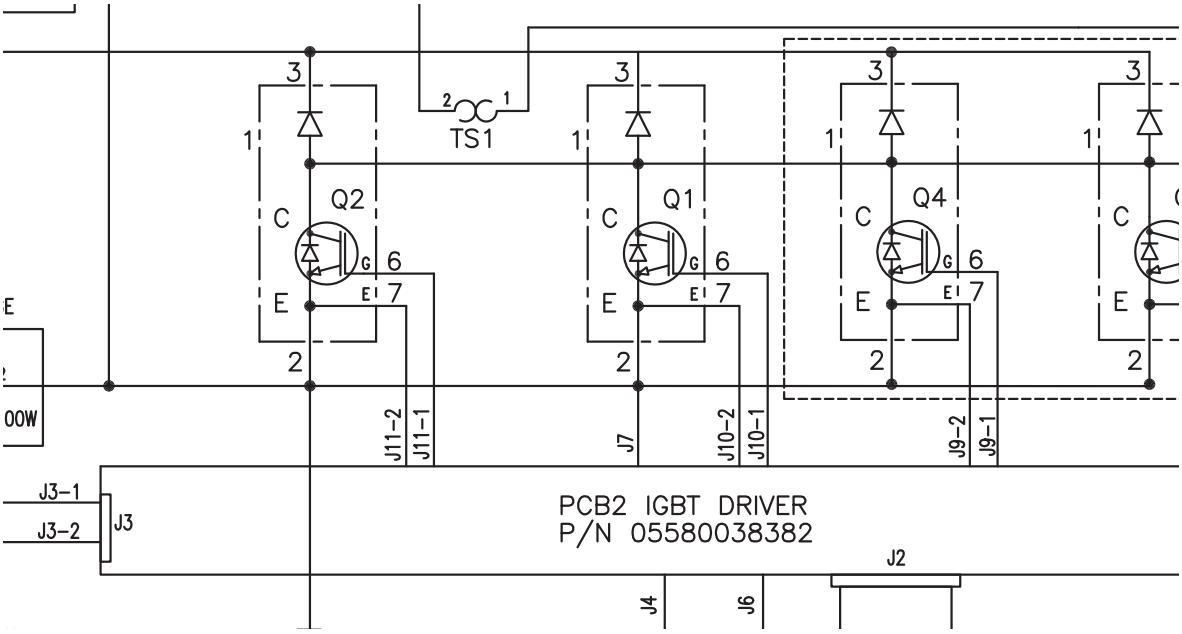


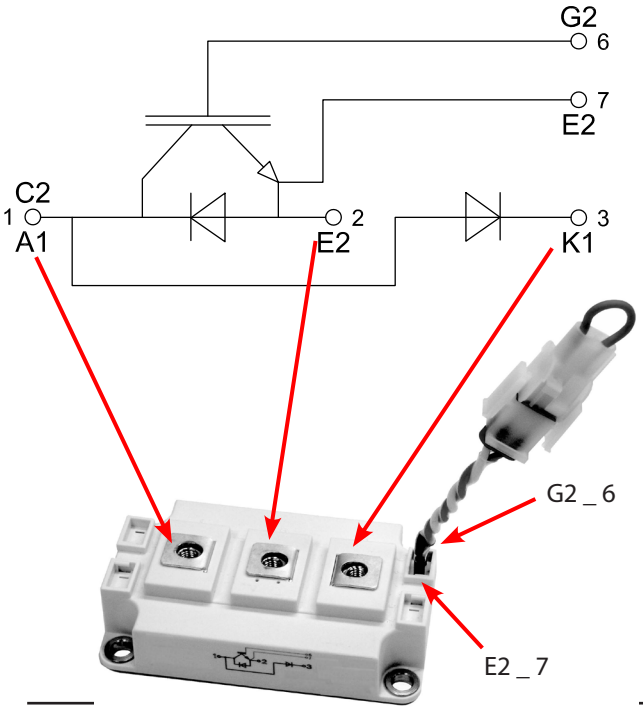


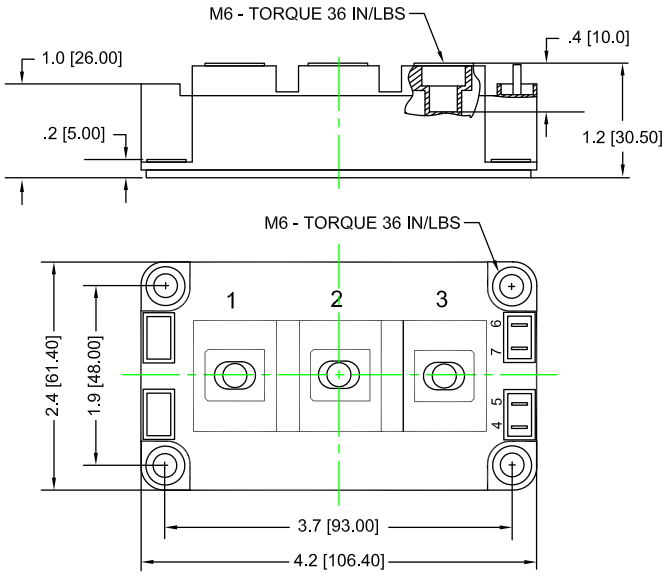
IGBT Q1-Q2 (0558006183)

The IGBTs are the devices used as an electronic switch to turn the output of the power supply on and off. During operation, these transistors are switched on and off 15000 - 24000 times a second to produce the output current of the EPP-362. These transistors are part of the IGBT block and are key components allowing a variable output of the power supply. These transistors produce heat during normal operation, which must be removed. A cold plate (water-cooled) mechanism is used to remove the heat from the IGBTs. Failure to remove this heat will result in the destruction of transistors. The IGBTs installed in the EPP-362 are rated for 400 amps of continuous current output and up to 1200 Volts DC of input.

Testing: see "IGBT Testing" in the General Information section.







0558006183 IGBT

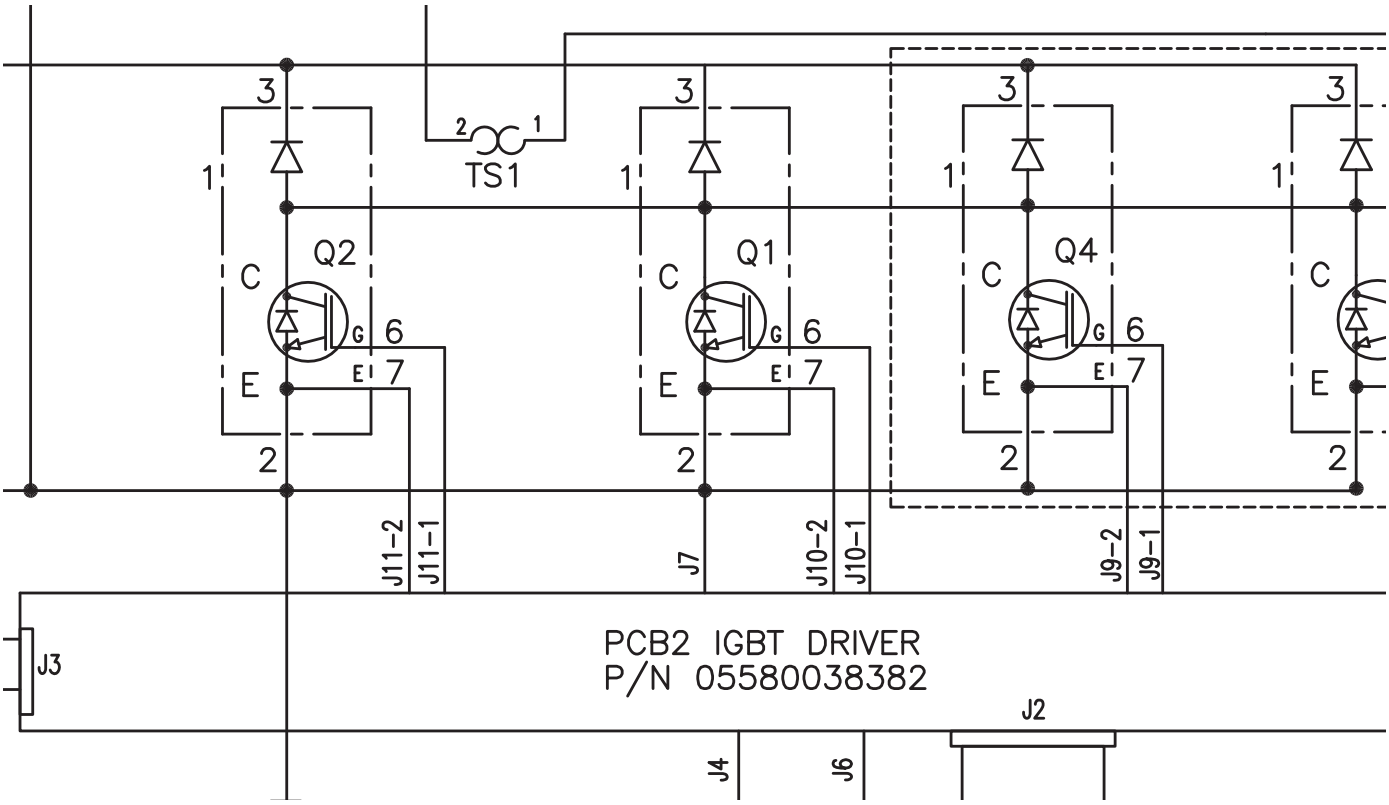
IGBT Driver Board PCB2 (0558038362)

Bias Supply

The Driver board has a bias supply built onboard to power its' own circuitry. The board receives 24 VAC in from the control transformer T2. The voltage is rectified, filtered regulated and then sent to the various circuits on the board.

24 VAC input on J5 pins 1 and 3 is rectified by the full wave bridge (D2, D3, D5, D6) and filtered by capacitor bank (C5, C6, C25, C48, C62). The voltage from capacitor bank is provided to U12 and U2 which will then provide regulated 24 HVDC and 9 HVDC output voltages.

Test point:
To check the +15 VDC supply, check the voltage between TP1 - +15 VDC - and TP2 – common. This should read +15 VDC +/- 10%.



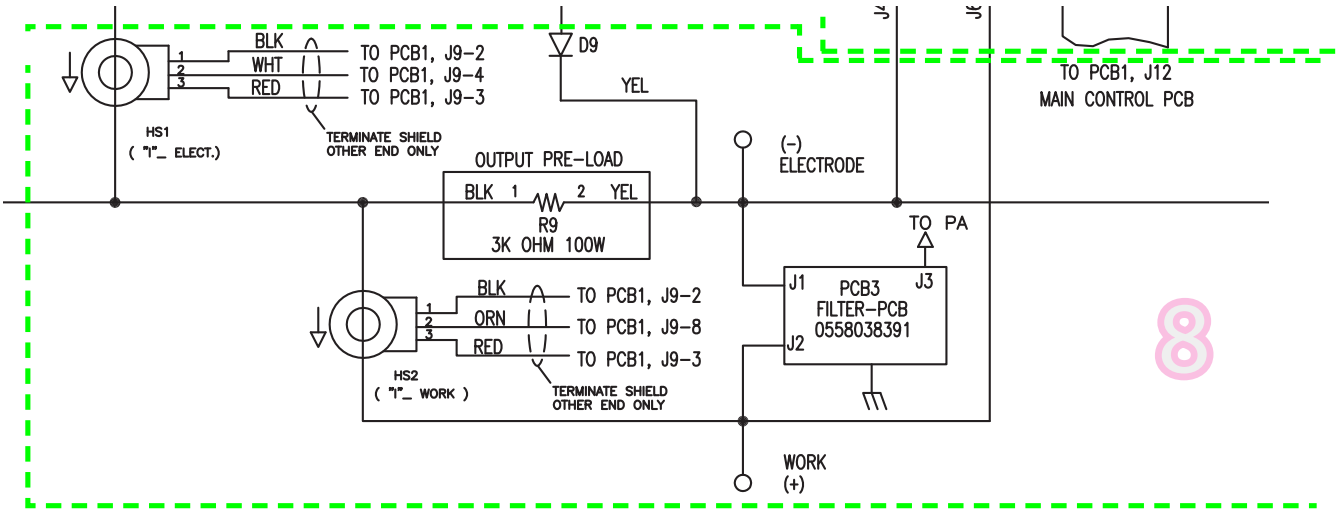
Hall Sensors HS1, HS2 (0558006886)

The Current sensors HS1 and HS2 (Hall Sensors or Hall Effect Sensors) provide current feedback to the Control Board PCB1. These two sensors detect the amount of current flowing through them and provide a signal back to the Control Board for output current regulation and passing to controller through CAN communications. These two hall sensors are closed loop sensors and as such do not need to be referenced to common.

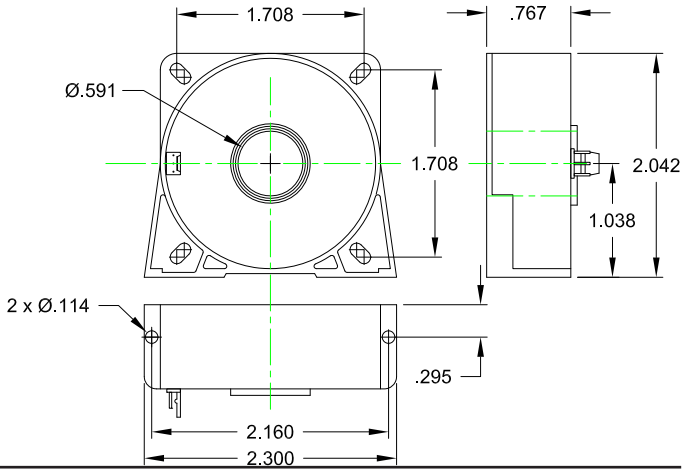
Functions:
The two hall sensors perform different functions on the EPP-362. HS1 detects the Pilot Arc and current to the electrode, while HS2 is used to detect current through the work lead. The only function that HS2 performs is Arc On detection.

The two hall sensors HS1 and HS2 are supplied with a positive and negative 15 VDC. The feedback signal is taken from pin 2 of the hall sensors and sent back to the Control Board PCB1, J8 connector.

Testing
Using an Ohm meter, the hall sensors may be checked. See the table below for resistance values.

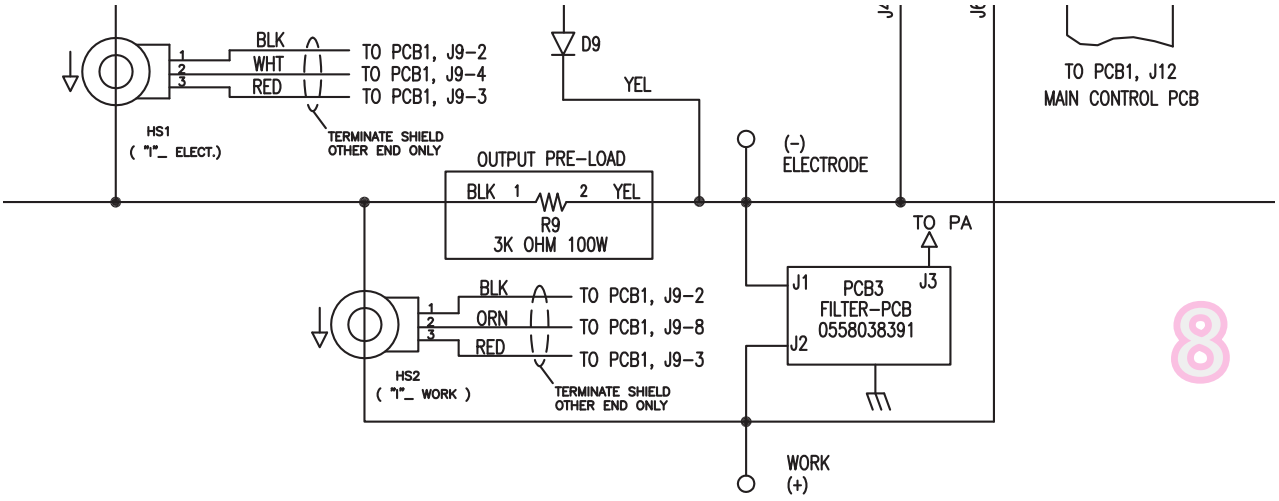


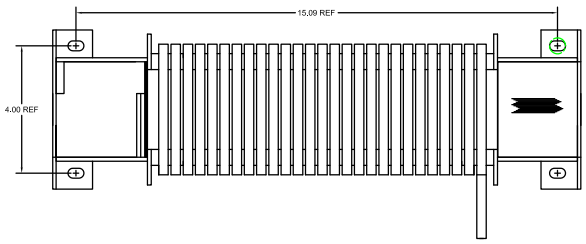
PINS	Positive	Negative	h
Pin 1 - 3	1	3	h
Pin 1 - 2	1	2	h
Pin 2 - 3	2	3	h
Pin 3 - 1	3	1	h
pin 2 - 1	2	1	h
pin 2 - 3	2	3	h

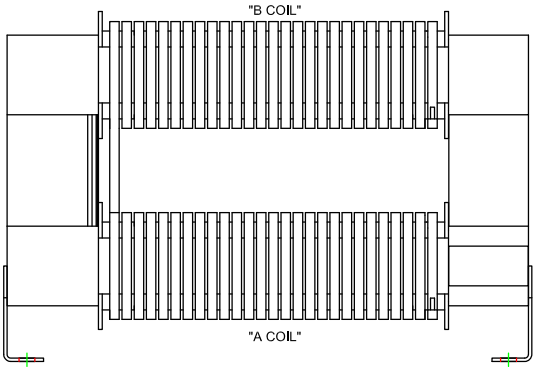


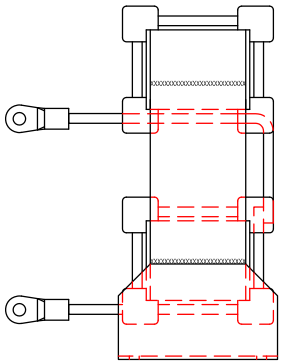
Output Inductor L1 (0558007254)

The output inductor L1 is in place to filter the output of the power supply and reduce output ripple.



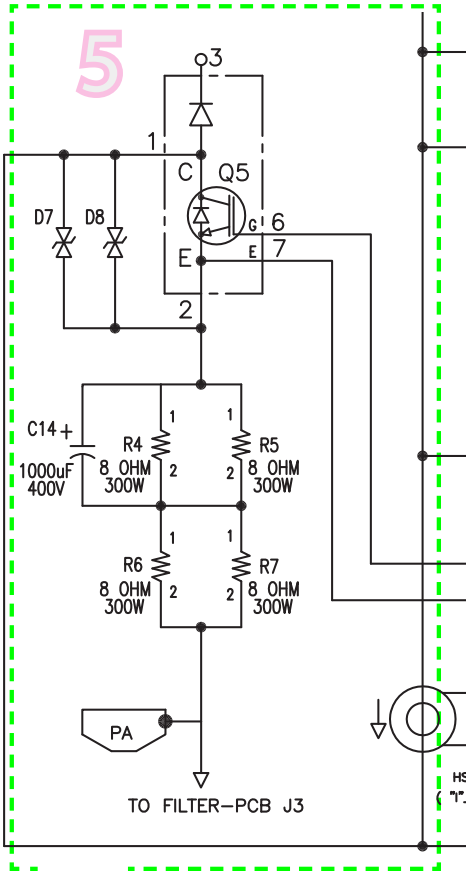




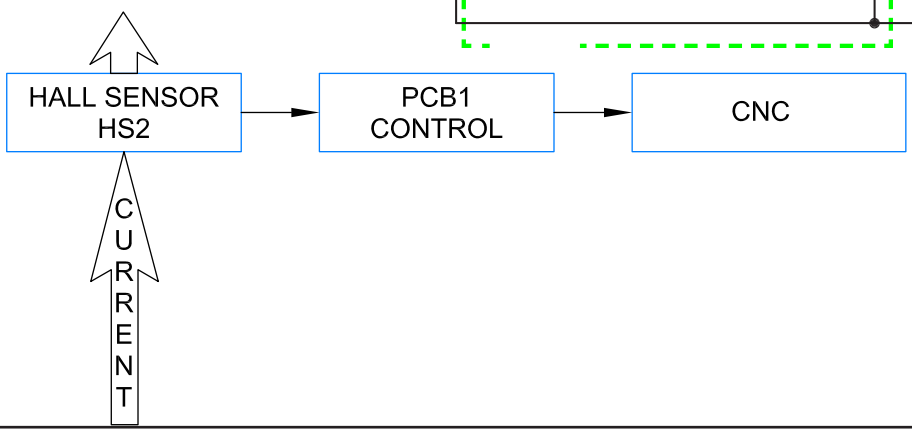


Pilot Arc

In the power supply sequence of events, the pilot arc "ON" must be detected before main arc "ON" signal can be issued. When power supply receives a start signal from the CNC/Process Controller, it goes through start-up sequence (refer to "Sequence of Events" in the Introduction section). Once the bus filter capacitor is fully charged, main micro issues 115 VAC to the HF Ignitor inside the RAS box and Pilot Arc ON and PWM ON signals to servo micro. Servo micro then issues PWM signals to pilot arc IGBT and main IGBT's. Since the process controller has already started the gas flow, due to the availability of HF signal and open circuit voltage from power supply an arc is established between electrode and nozzle which is called PILOT ARC. When pilot arc is established the hall sensor (HS1) reads the current which is used to turn OFF the 115 VAC to HF Ignitor. When plate (work) is close enough to the torch (electrode), the arc will transfer to the plate forming the current path detected by hall sensor (HS2) which helps the servo micro to regulate the PWM signals for requested cutting currents. The following schematic shows the pilot arc circuit used in EPP-362 power supply.



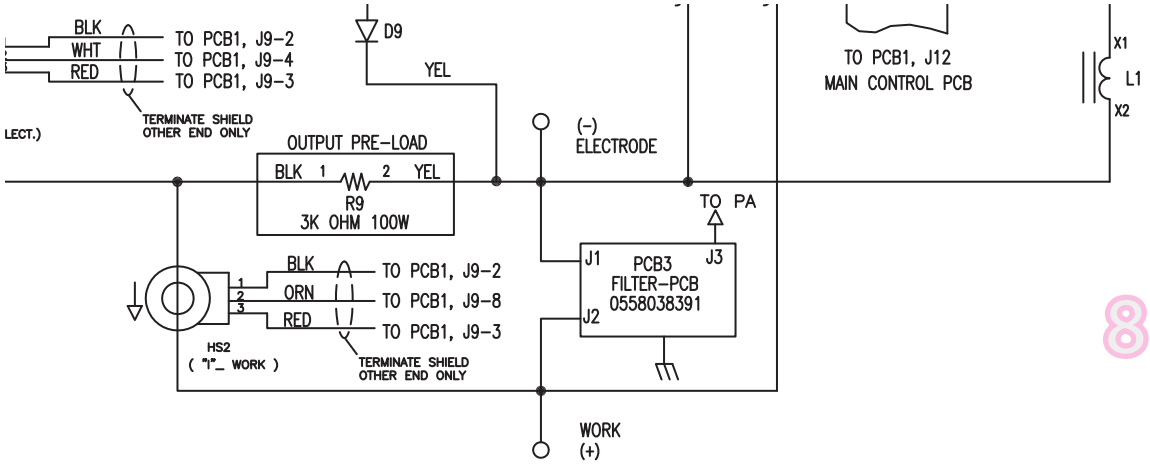
Arc On Block Diagram

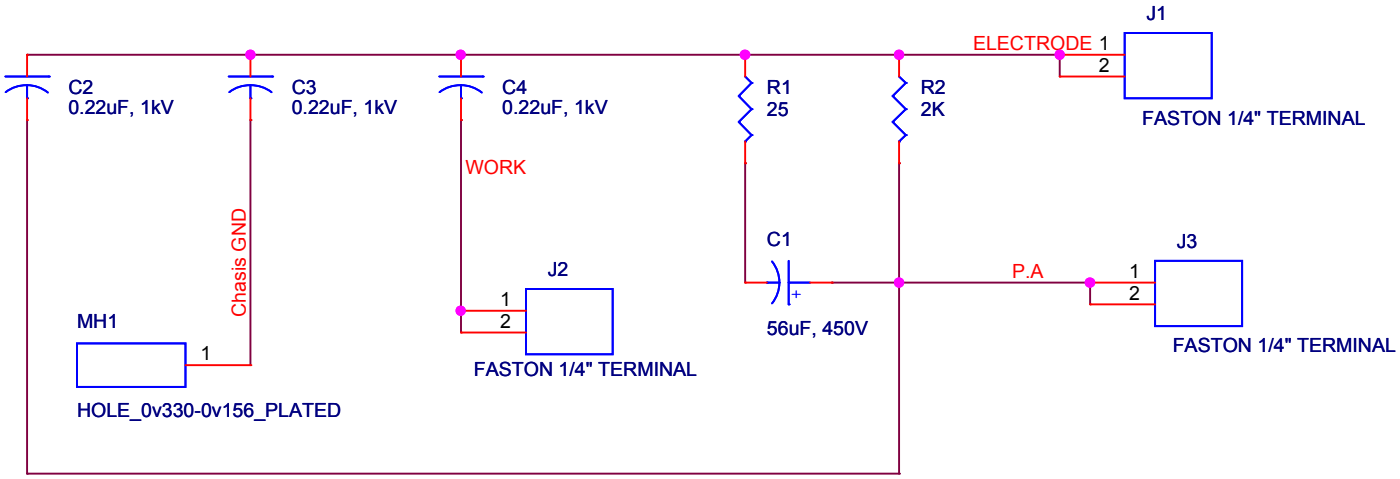


Filter and Start-Up Board PCB3 (0558038391)

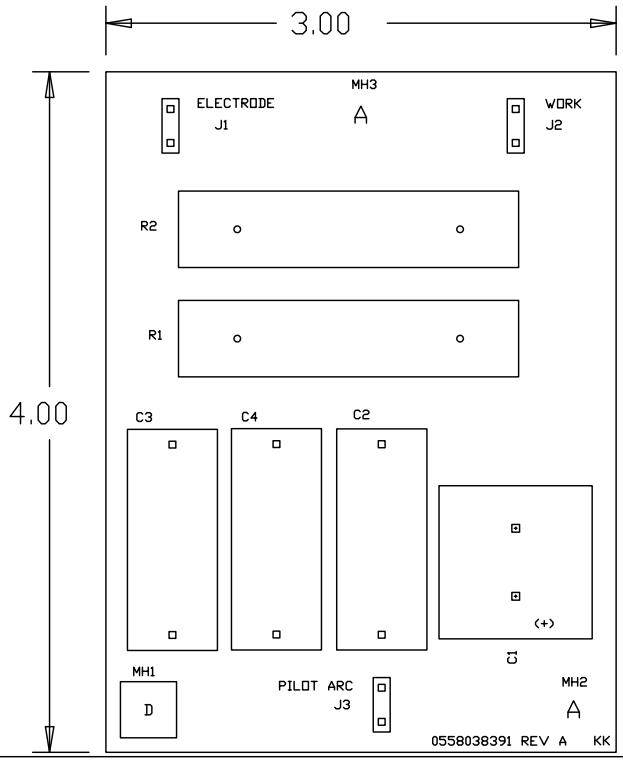
The board is in place to prevent high frequency noise from entering the power supply and either damaging the power supply or inducing transient fields in the Hall sensor that may send an inaccurate current signal to the CNC. The filter networks are constructed so as to shunt high frequency AC signals to ground.

This PC board also has a Start-up circuit which connects between nozzle and electrode. The Start-up circuit helps in establishing the pilot arc between nozzle and electrode. The below schematic shows Filter and Start-up circuit in which C1-R1-R2 forms the Start-up circuit and remainder of the circuit forms the filter network.





Filter Board PCB3 (0558038391)



DRILL CHART: TOP to BOTTOM			
ALL UNITS ARE IN MILS			
FIGURE	SIZE	PLATED	QTY
□	60.0	PLATED	12
○	70.0	PLATED	4
⊡	75.0	PLATED	2
D	156.0	PLATED	1
A	156.0	NON-PLATED	2

Item	Quantity	Reference	Part	Description
1	1	C1	56uF, 450V	CAPACITOR, ALUMINUM ELECTROLYTIC, 56uF, 450 VDC, TOL: +/- 20%
2	3	C2,C3,C4	0.22uF, 1kV	CAPACITOR, METALIZED FILM, 0.22uF, 1000 VDC, TOL: +/- 20%
3	3	J1,J2,J3	FASTON 1/4" TERMINAL	FASTON, 1/4" Faston Blade
4	1	MH1	HOLE_0v330-0v156_PLATED	Mounting Hole
5	1	R1	25	RESISTOR, 25 OHMS, 20W, 5%
6	1	R2	2K	RESISTOR, 2K, 20W, 5%

Filter Bus

The Filter Bus consists of a 6000 microfarad capacitor used to smooth out the rectified input power. This capacitor C1 is connected between the input bridge and the IGBTs. The filter cap provides 360 VDC to the IGBTs to supply the output of the power supply. Connected in parallel with the filter capacitor is R8, a 3 K Ohm 100 watt resistor used as a bleeder resistor. This is used to drain the left over charge on the capacitor once the power supply is turned off. The time required to dissipate the charge is as follows:

18 seconds = 63.21% of the charge reduced or 132 VDC remaining.
53 seconds = 94.81 % of the charge reduced or 18 VDC remaining.

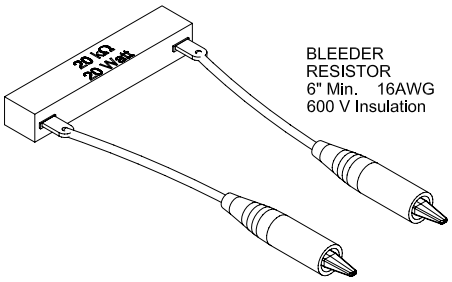
Capacitor Information

CAUTION

Serious Shock Possible!

Bus cap warning

Serious Shock Possible



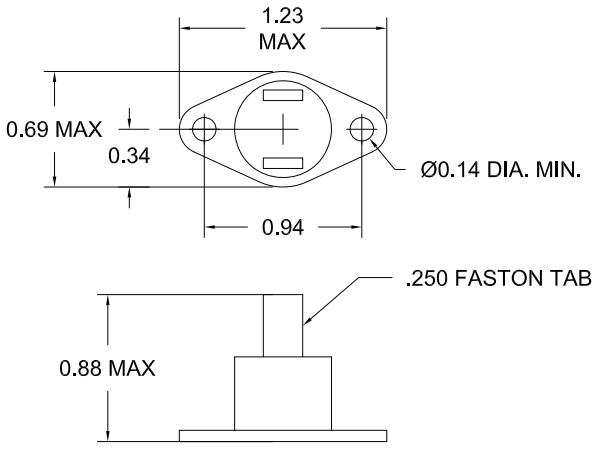
The "bus capacitor" in the EPP-362 will maintain a voltage charge for approximately 2 minutes after power is removed from the input of the machine.
The arcing caused by discharging a capacitor into a short-circuit can cause injury and component damage
To eliminate the voltage from the capacitor, connect the "bleeder resistor" across the poles of a charged capacitor and the stored energy will discharge harmlessly through the resistor. The approximate discharge time is 30 seconds.
When discharged, the cap can be partially tested by using a multimeter set to the ohms scale. When checking a capacitor…Connect the + meter lead to the + pole of the capacitor, and the – lead to the – pole. The meter display will show a number that will change while the leads are connected, if the meter leads are reversed, the display will change polarity and the value will change in the opposite direction from the first test, if the capacitor is good.

Temparature Monitoring

Two thermal switches connected in series monitor the internal temperature of the EPP-362. TS1 mounted on the IGBTs cold plate rated to open at temperature 176 °F and TS2 mounted on the bridge rectifier is rated to open at 212 °F.
Surface mount Thermistor (RT1) on the control board (PCB1) monitors the ambient temperature in the control box. Thermistor sends an analog voltage signal proportional to the ambient temperature.
Main micro U19 on PCB1 read these temperature sensors information for fault monitoring.

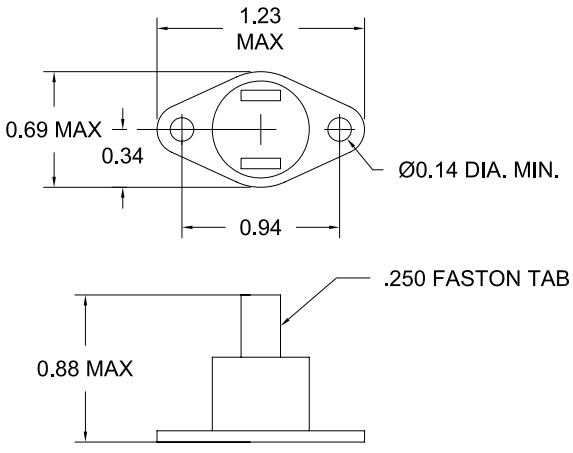
DESCRIPTION:

NORMALLY CLOSED THERMAL SWITCH
OPEN TEMP. 212 ±5° F
CLOSE TEMP. 192 ±7° F
CONTACT RATINGS: 12 AMP MIN @12OVAC
8 AMP MIN @ 24OVAC
EPOXY SEAL ON THE DISC CUP AND TERMINALS
U.L. RECOGNIZED
CSA CERTIFIED PRODUCT



DESCRIPTION:

NORMALLY CLOSED THERMAL SWITCH
OPEN TEMP. 176 ±5° F
CLOSE TEMP. 156 ±5° F
CONTACT RATINGS: 15 AMP MIN @12OVAC
8 AMP MIN @ 24OVAC
EPOXY SEAL ON THE DISC CUP AND TERMINALS
U.L. RECOGNIZED
CSA CERTIFIED PRODUCT



DESCRIPTION OF OPERATION

Coolant Circulator

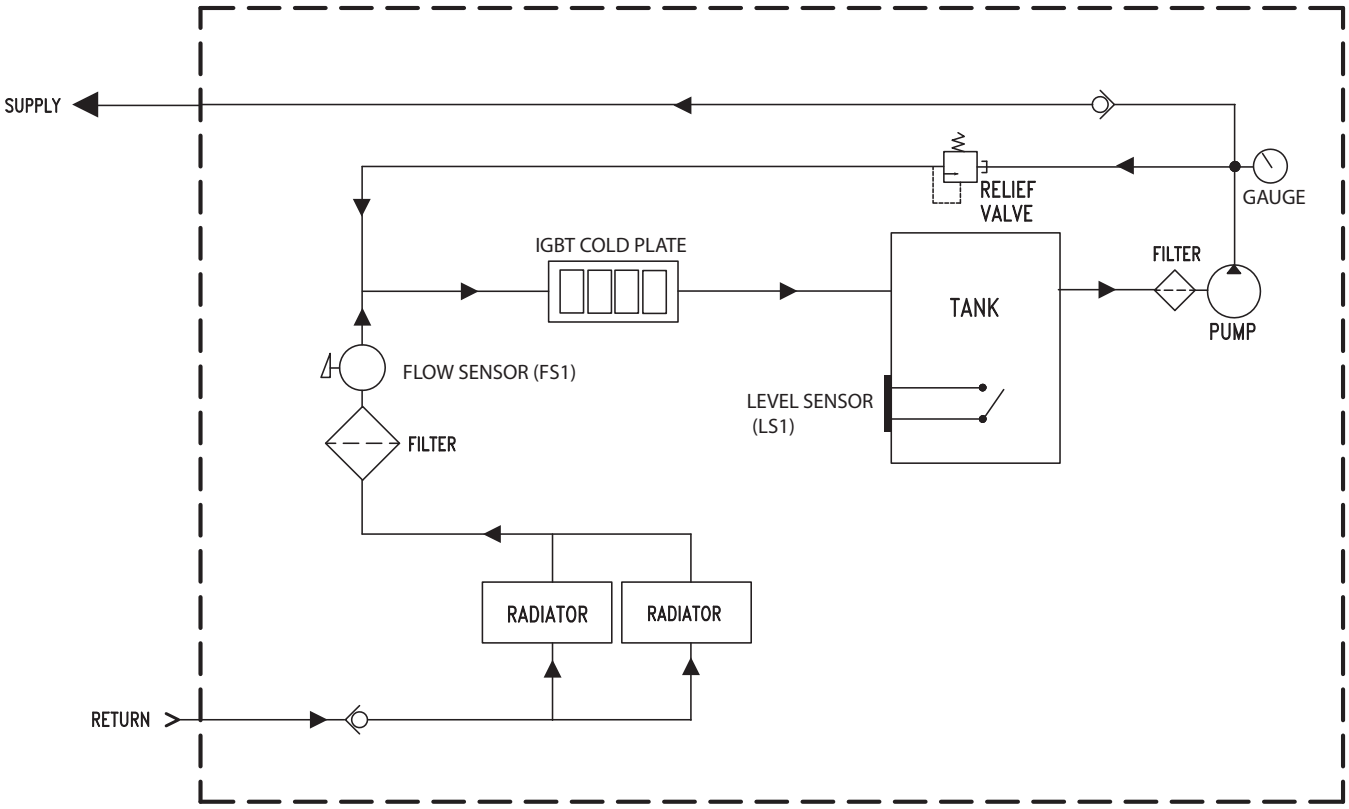
EPP-362 Power Source has inbuilt coolant circulator which circulates coolant to torch and IGBTs cold plate. Circulator consists of Pump, Motor, Radiators, Regulator, Flow Sensor, and Level Switch.

Specifications

Pump Type: Positive displacement, rotary vane type with adjustable by-pass valve (225 psi / 15.5 bars max.), CW rotation as viewed from nameplate.		
Radiator Type: Copper tubing, aluminum finned air-to-water type with galvanized steel frame.		
	50Hz, 1 Phase Input Power	**60Hz, 1 Phase Input Power**
AC Input Voltages	230 V, + / - 10%	
AC Input Amperage	8 Amperes	
Pump Capacity	1.60 gpm at 175 psi (6.0 l/min at 12 bars)	1.60 gpm at 175 psi (6.0 l/min at 12 bars)
Cooling Capacity @ 1.60 gpm (6.0 l/min) at 45° F (25° C) temperature difference between high coolant temperature and ambient air temperature using ESAB coolant (25% propylene glycol / 75% distilled water).	16,830 BTU / hr. (4900 watts)	20,200 BTU / hr. (5900 watts)
Max. Delivery Pressure	175 psig (12 bars)	
Reservoir Capacity	4 gallons (15.2 liters)	

Operation

As soon as the power source is supplied input power, the coolant pump motor turns ON and pumps the coolant. Coolant pumps out to the torch and returns back to the coolant tank through radiators, filter, flow sensor, and IGBTs cold plate respectively. The pump has an internal adjustable bypass valve set to 225 psi (15.5 bar). There is also an external adjustable regulator, set to 175 psi (12 bar), to bypass the coolant flow if pressure exceeds 175 psi (12 bar). The coolant flow diagram is as shown in the figure below.



Coolant Flow Diagram

Please refer to Replacement Parts section in the back of this manual for more details.

DESCRIPTION OF OPERATION

Flow sensor

RotorFlow Sensor is used to monitor the flow rate of the coolant.

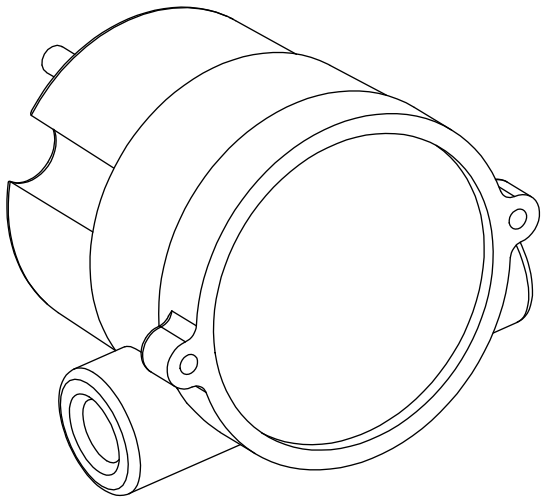
Operation: The rotor reacts to turbulence, pulsation, entrained air, and other flow anomalies induced in the flow stream by other process hardware. For optimum performance, install RotorFlow units where nominal flow conditions exist, with ports located at the top. Incoming flow may be placed to either port. A minimum of 8° of straight pipe on the inlet side is recommended. Frequency output (RFO) is determined by the velocity of the monitored fluid acting on the sensor rotor. Input piping with an orifice smaller than that of the sensor input will effect the sensor output.

Installation: RotorFlow sensors connect to piping via NPT mating thread forms. The following guidelines are provided to assist with installation for a leak-free seal, without damage to the unit:

1. Apply pipe thread sealant to male pipe threads.
2. Thread RotorFlow unit onto male pipe thread until hand-tight.
3. Tighten pipe 1 to 1-1/2 additional turns.
4. If improper seal results, continue turning pipe into unit in ¼ turn increments.

Recommended Pipe Sealants: (a) Permatex “No More Leaks” (b) Teflon Thread Tape.

Filteration and Cleaning: 150 micron filteration is recommended. However, should foreign particles enter the RotorFlow sensor, accumulation is easily cleared by removing the lens from the body. The lens is removed by turning its center rib 45° counter-clockwise and then pulling it out. To reinstall the lens, simply reverse the process. Pressure must be relieved from the system prior to sensor clean-out.

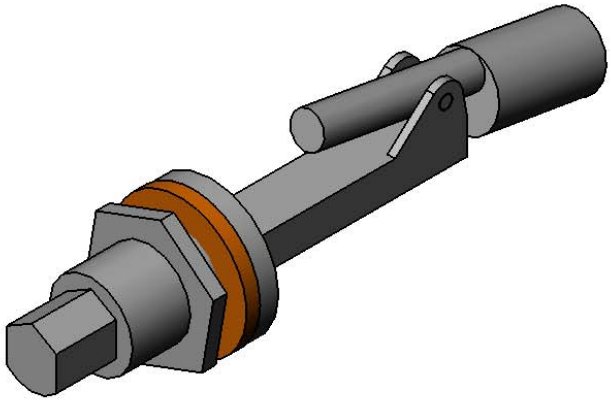


DESCRIPTION:

Sensor Type: RotorFlow
Low Flow Range (GPM): 0.1. - 1.0
Standard Flow Range (GPM): 0.5 - 5.0
Flow Range (GPM): 0.1 - 5.0
Body Material: Polypropylene
Port Size: 1/4 NPT Female
Input Power: 4.5 VDC to 24 VDC
Output: 4.5 VDC to 24 VDC Pulse (Sourcing)
Low Flow Accuracy: ±7%
Standard Flow Accuracy: ±7%
Maximum Pressure (PSI): 100
Minimum Temperature (°F): -20
Maximum Temperature (°F): 180.000
Electrical Termination: 22 AWG, 24"-24" PVC Cable
Recommended Filtration: 150 micron

Level Switch

Level switch is used to tell if the level of coolant in the tank drops below certain level. When the level of the coolant drops below level switch position in the tank, control board reads the switch open signal, an error signal is sent to CNC/Process controller by the power supply through CAN communication.



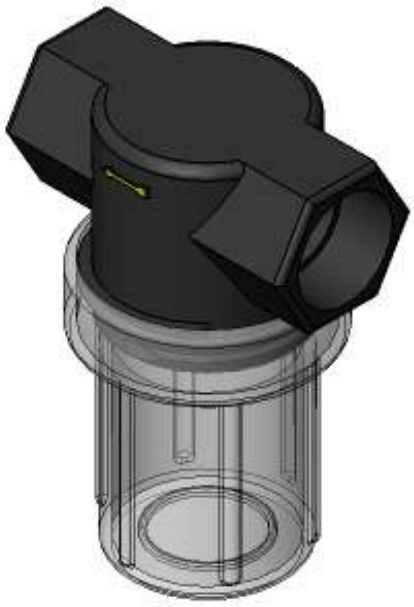
DESCRIPTION:

PLASTIC SIDE-MOUNTED SWITCH

STEM:	**POLYPROPYLENE**
FLOAT:	**POLYPROPYLENE**
MAX TEMP:	**105C**
NOM CURRENT:	**30VA SPST SWITCH**
FLOAT SG:	**0.60**
MAX PRESSURE:	**100PSIG**
LEADS:	**22GA, 24INCHES**

Coolant Filter

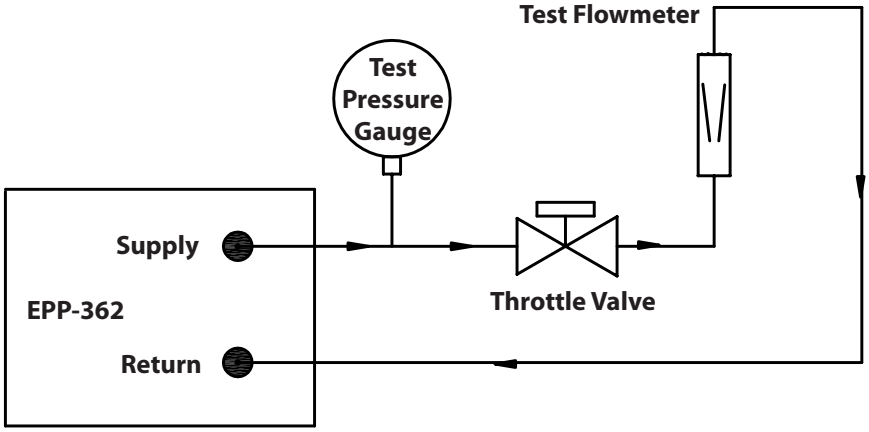
A filter is used to prevent the foreign particles entering the power source through coolant and damaging the equipment.



DESCRIPTION:

3/4" MINI T-STRAINER W/CLEAR BOWL

Test Procedure



Field Test Procedure

Test Procedure:

1. Connect as shown above using 0.38" (9.5 mm) ID hose.
2. Open throttle valve completely.
3. Fill tank with Plasmarc torch coolant.
4. Power ON the EPP-362 power source.
5. Adjust throttle valve until test flowmeter reads 1.5 gpm (5.7 l/min)
6. Read pressure on test pressure gauge. It should be between 160 - 185 psig (11.0 - 12.8 bar).
7. Check interior of EPP-362 power source for leaks.

PCB1 Control Board (0558038362)

Introduction

The Control board on the EPP-362 governs the operation of the power supply. The board consists of circuits that control the following:

Pulse generation
Fault monitoring
Initiation of the bus supply
Arc Detection
(HF) High Frequency Circuit
Slave/master functions
Initiation of Pilot Arc
Current output regulation
Arc On signal generation
Mark Mode VDR Circuit

The use of a microcontroller on this board co-ordinates these functions and interfaces directly to the CNC through CAN communication. The Control Board connects directly to a pair of Hall Sensors for current detection and regulation, supplies pulses to the IGBTs through the Driver Board PCB2.

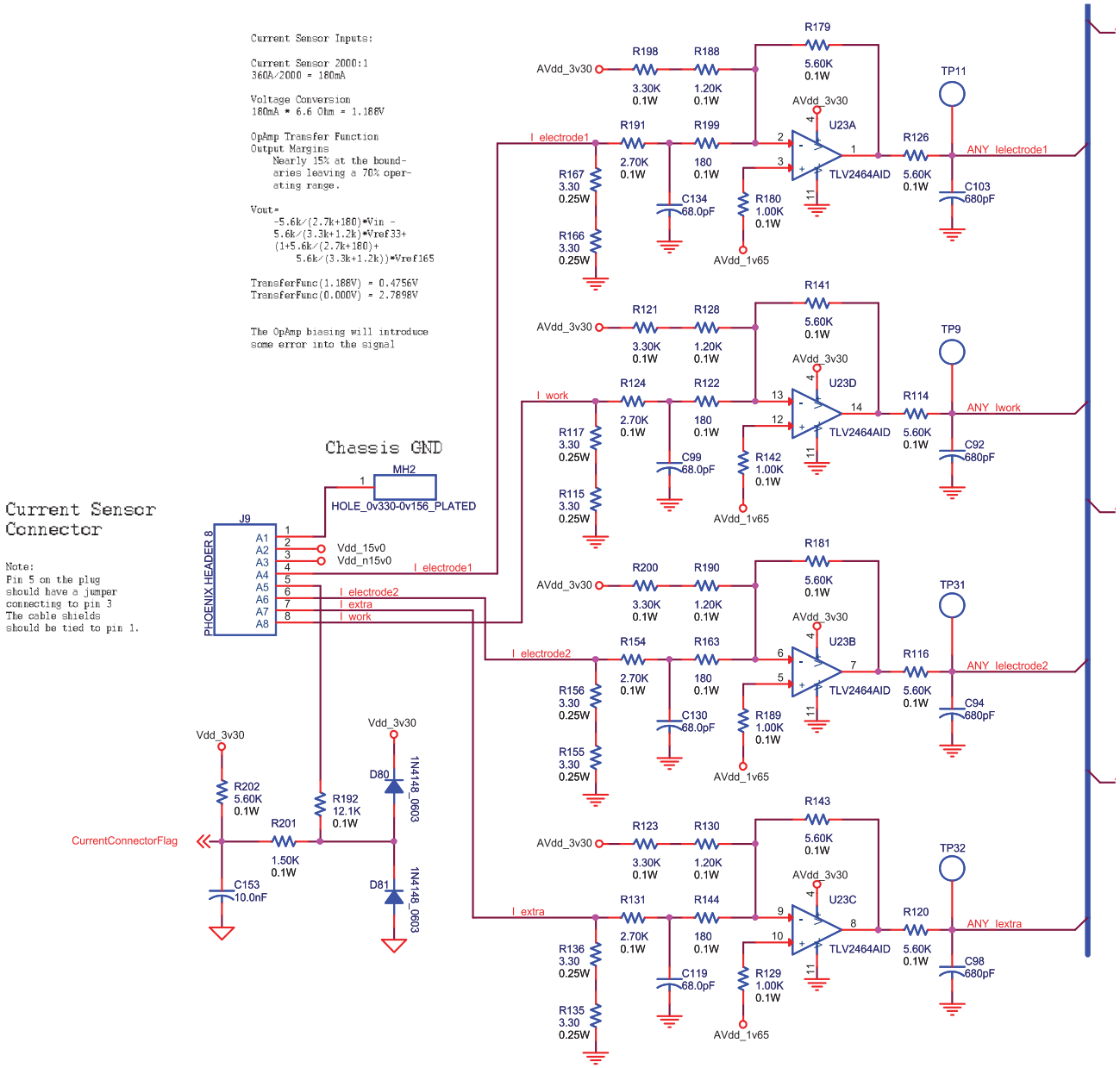
Control board (PCB1) consists of two micro-controllers, one called Main micro which controls the process sequence, communication with controller, digital and analog IO signals, fault monitoring, coolant flow and level monitoring etc., other called Servo micro which is used to generate the PWM signals for switching IGBTs, monitoring the currents and voltages.

PCB1 Schematics - (0558038362)

Refer to Appendix B in the back section of this manual for complete schematics.

Current Monitoring

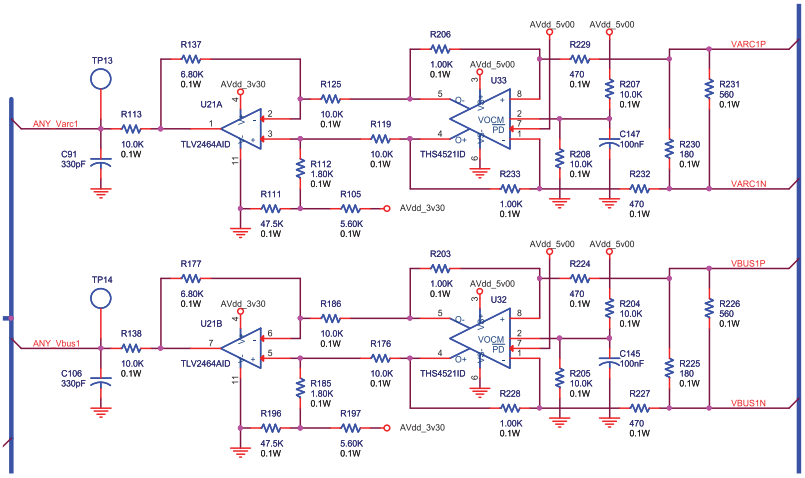
Control board monitors the output current all the time for proper operation. Servo micro-controller section of the control board reads the current signals from the Hall Sensors (HS1 and HS2) connected to J9 pins 4 and 8. Since micro controller requires voltage signal, the current signal from the hall sensor is fed through a small resistor of 6.6 Ohms. The voltage across this resistor is fed through OPAMP (U23) circuitry, which will generate respective voltage signal proportional to the scaled current signal. Servo micro processes these signals and outputs scaled integer value to main micro-controller through SPI communication. Main micro uses these values for main process control and fault monitoring. Control board has a provision for monitoring four closed-loop hall sensor inputs. See Appendix B for detailed schematics. Refer to Help Codes for current related error codes.



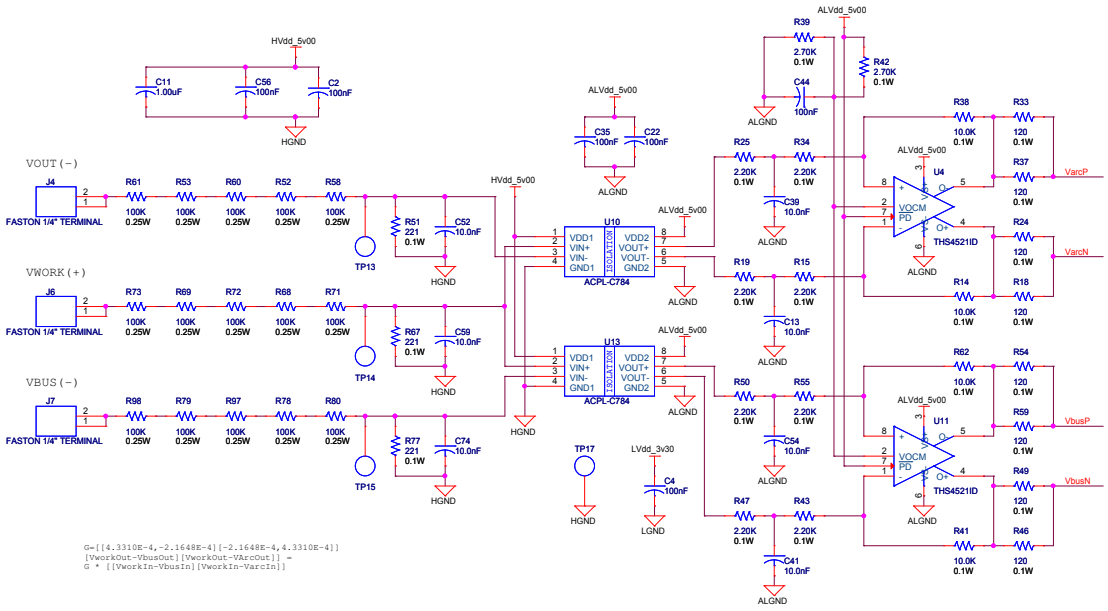
PCB1 Voltage Monitoring Circuits (0558038362)

The voltage monitoring circuits are in place to monitor the bus and arc voltage levels for main process control and fault monitoring. Driver Board (PCB2) reads the voltages directly from the respective positions in the power supply and scales the values down to the microcontroller range (Refer to PCB2 Driver Board section for PCB2 details). The Servo Micro (U17) reads the voltages from Driver Board (PCB2) through J12 or J13 connector and OPAMP (U32 and U33) circuitry. Servo micro processes the scaled values and outputs the scaled integer values to the main micro through SPI communication. Refer to Help Codes for voltage related error codes. See Appendix B for detailed schematics.

Control Board Voltage Monitoring Circuit



Driver Board Voltage Monitoring Circuit



PCB1 PWM (0558038362)

The Pulse Width Modulator Circuit, referred to as PWM, is the circuit that generates the pulses to trigger IGBTs ON and OFF.

The Servo Micro (U17) generates the PWM signals ranging from 15 KHz to 25 KHz based on the current signal. These PWM signals from the servo micro are fed through logic gates to generate positive and negative pulses. These pulses are sent to the Driver Board (PCB2) (Refer to PCB2 Driver Board section for PCB2 details), through J12 or J13 connector on the PCB1, where IGBT gate and emitter connections are made. Reference the PCB1 and PCB2 test point chart. See Appendix B for detailed schematics.

PCB1 Output Circuits (0558038362)

EPP-362 power source interfaces with CNC/Process Controller through either CAN communication or analog connection.

CAN Communication Interface:
Control board interfaces with CNC or Process Controller through CAN communication protocol. There are two sets of communication circuits available on the PCB1: U26, U46 comprise one set, and U27, U38 comprise other. Via CAN communication power source sends the required output signals to CNC or Process Controller.

Analog Interface:
The control board sends the output signals to control various functions. Refer to Appendix D for the output connector information.
See Appendix B for detailed schematics.

PCB1 Input Circuits (0558038362)

As mentioned in previous section, EPP-362 power source interfaces with CNC/Process Controller through either CAN communication or analog connection.

CAN Communication Interface:
The control board via CAN communication reads the inputs from the CNC or Process Controller. These input signals are used by the main micro U19 for the main process sequence.

Analog Interface:
Control board reads the input signal information from the external circuitry. Refer to Appendix D for the input connector information.

See Appendix B for detailed schematics.

PCB1 Bias Supply (0558038362)

The control board (PCB1) generates the onboard supply voltages to power the circuits on the board.

Positive and Negative 15 VDC Bias Supply:

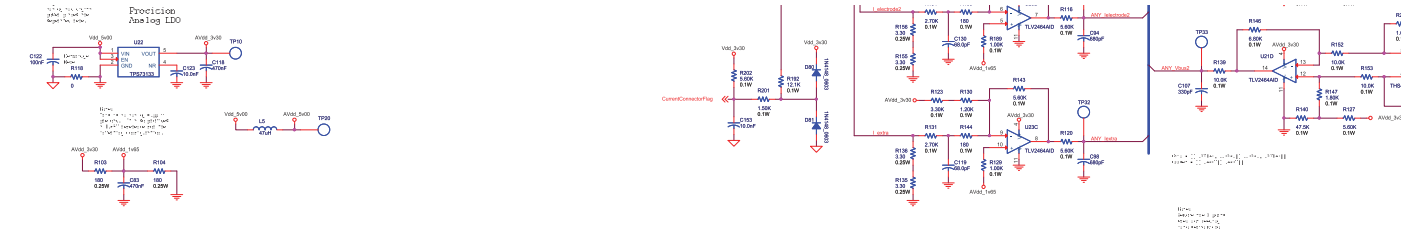
The board receives centered tapped 34 VAC from control transformer (TB3-13, TB3-14 and TB3-15) on pins 1, 2 and 3 of connector J3. This center-tapped supply is used to provide both positive and negative output bias voltages.

Positive 15 VDC Bias Supply: The 17 VAC input on pins 1 and 2 of connector J3 is rectified through diode bridge rectifier circuit (D7, D8, D11, and D12) and filtered by a capacitor. This filtered DC is sent through a regulator U8 to have +15 VDC which powers the circuits needing +15 volts. The filtered DC is also fed through a regulator U7 to have +5 VDC bias supply which powers the circuits needing +5 volts. The positive 15 volts is also sent to the microcontroller for monitoring the +15 VDC bias supply availability.

Negative 15VDC Bias Supply: The 17 VAC input on pins 2 and 3 of connector J3 is rectified through diode bridge rectifier circuit (D7, D8, D11, and D12) and filtered by a capacitor. This filtered DC is sent through a negative 15 volt 3-pin regulator (U9) to have -15 VDC bias supply which powers the circuits needing -15 volts. The negative 15 volts is also sent to the microcontroller for monitoring the -15 VDC bias supply availability.

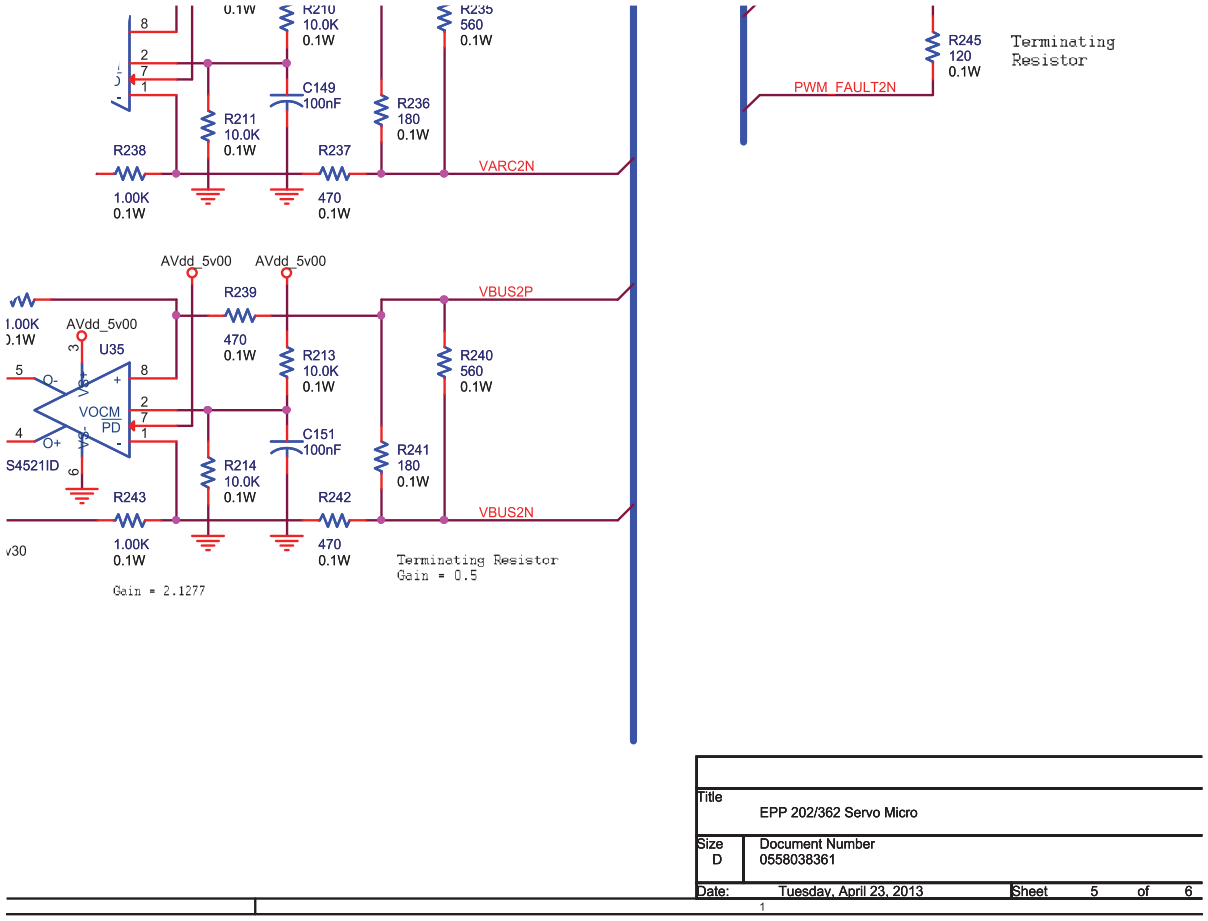
Positive 24 VDC Low Power Bias Supply

The board receives 24 VAC from control transformer (TB3-4 and TB3-5) on pins 4 and 5 of connector J3. This 24 VAC is rectified through diode bridge rectifier circuit (D5, D6, D9, and D10) and filtered by a capacitor. This filtered DC is sent through a regulator U6 to have regulated 24 VDC. This regulated 24 VDC besides powering the circuits requiring 24 volts, also sent to microcontroller for monitoring the 24 VDC bias supply availability.



Positive 24 HVDC High Power Bias Supply:

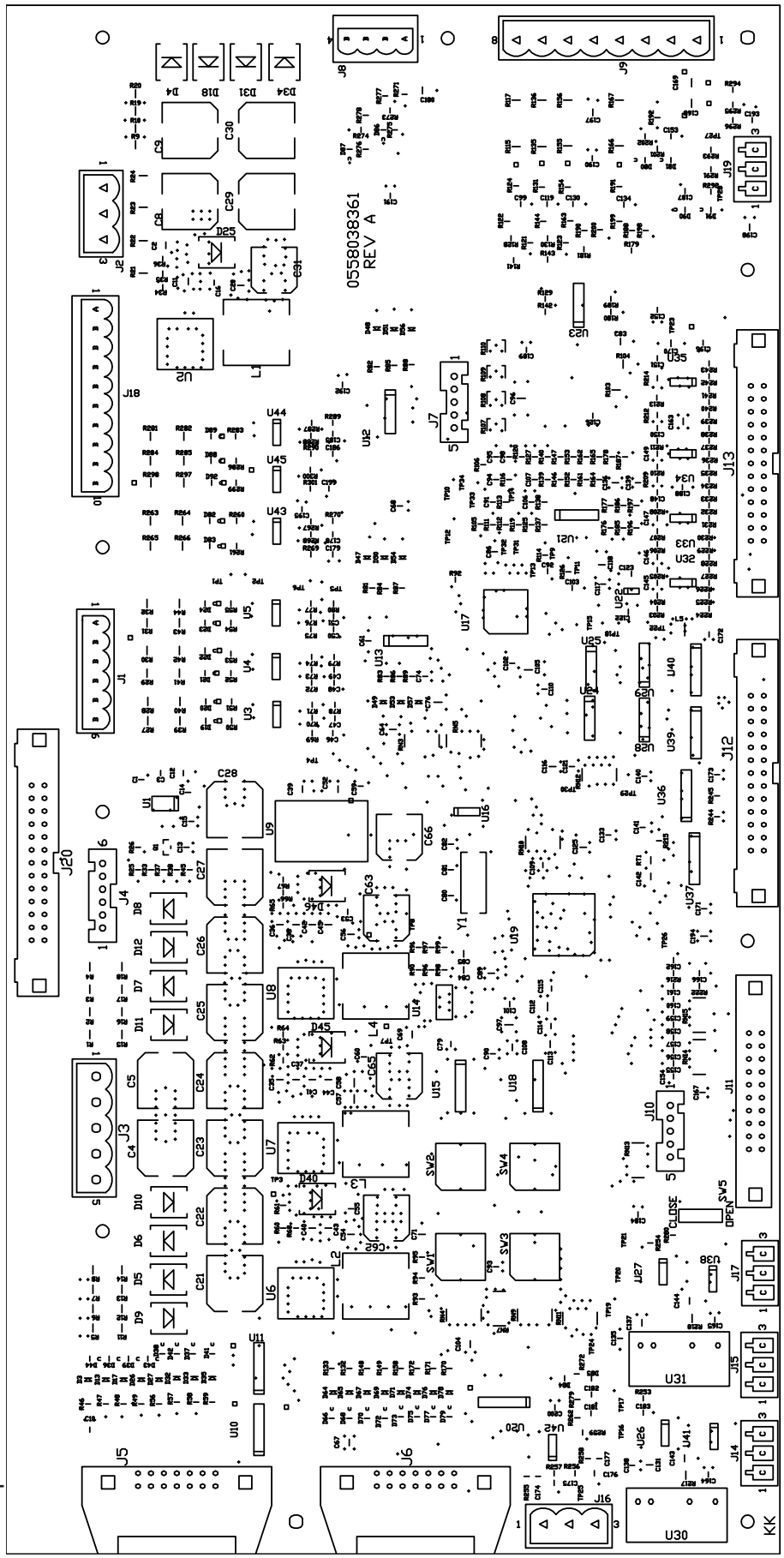
The board receives 24 VAC from the control transformer (TB3-9 and TB3-10) on pins 1 and 2 of connector J2. The 24 VAC is rectified through diode bridge rectifier circuit (D4, D18, D31, and D34) and filtered by a capacitor. This filtered DC is sent though a regulator U2 to have 24 HVDC. This regulated high power 24 HVDC is used to power the isolated digital inputs.



PCB1 Test Points

Test Point	Expected Value	Signal	Function
TP1	24 VDC	HVdd_24v0	24 VDC for high voltage isolated digital inputs
TP2	0 VDC	HV_GND	High voltage common reference
TP3	24 VDC	Vdd_24v0	24 VDC bias supply
TP4	-15 VDC	Vdd_n15v0	Negative 15 VDC bias supply for hall sensors
TP5	0 VDC	DGND	Digital Common Reference
TP6	3.3 VDC	Vdd_3v30	3.3 VDC digital bias supply for micro
TP7	5 VDC	Vdd_5v00	5 VDC bias supply
TP8	15 VDC	Vdd_15v0	15 VDC bias supply for hall sensors
TP9		ANY_Iwork	Work Current Signal from the hall sensor. 2.8 VDC = 0 Amps, 0.5 VDC = 360 Amps
TP10	3.3 VDC	AVdd_3v30	3.3 VDC analog bias supply for micro
TP11	0 to 3.3 VDC	ANY_Ielectrode1	Electrode Current Signal from the hall sensor. 2.8 VDC = 0 Amps, 0.5 VDC = 360 Amps
TP12	0 VDC	AGND	Analog Common Reference
TP13	0 to 3.3 VDC	ANY_Varc1	Output Voltage Signal from the PCB2. 2.9 VDC = 0 VDC, 0.5 VDC = 360 VDC
TP14	0 to 3.3 VDC	ANY_Vbus1	Bus Voltage Signal from the PCB2. 2.9 VDC = 0 VDC, 0.5 VDC = 360 VDC
TP15		RAW_PWM1L	PWM Signal for IGBTs
TP16		C1TX	CAN 1 transmit signal
TP17		C1RX	CAN 1 receive signal
TP18	0 VDC	DGND	Digital Common Reference
TP19	0 VDC	DGND	Digital Common Reference
TP20		C2TX	CAN 2 transmit signal
TP21		C2RX	CAN2 receive signal
TP22		RAW_PWM1H	PWM Signal for IGBTs
TP23	5 VDC	AVdd_5v00	5 VDC analog bias supply
TP24	0 to 3.3 VDC	FlowSensorInput	Voltage signal in to the micro proportional to the coolant flow rate
TP25	35 Hz to 225 Hz	FlowFreqIN	Frequency signal from the flow sensor
TP26	0 to 3.3 VDC	ANX_MainRefPot	Voltage signal proportional to the set current
TP27	10 VDC	10 VDC	10 VDC bias supply
TP28	0 to 10 VDC	VOLT REF.	Voltage signal from external CNC or Process controller for current reference
TP29		RAW_PWM2H	PWM Signal for IGBTs
TP30		RAW_PWM2L	PWM Signal for IGBTs
TP31	0 to 3.3 VDC	ANY_Ielectrode2	Electrode Current Signal from the hall sensor. 2.8 VDC = 0 Amps, 0.5 VDC = 360 Amps
TP32	0 to 3.3 VDC	ANY_Iextra	Current Signal from the hall sensor. 2.8 VDC = 0 Amps, 0.5 VDC = 360 Amps
TP33	0 to 3.3 VDC	ANY_Vbus2	Bus Voltage Signal from the PCB2. 2.9 VDC = 0 VDC, 0.5 VDC = 360 VDC
TP34	0 to 3.3 VDC	ANY_Varc2	Output Voltage Signal from the PCB2. 2.9 VDC = 0 VDC, 0.5 VDC = 360 VDC

PCB1 Board Layout



PCB1 BOM (0558038362)

0558038362 Control Assembly Components			
ITEM #	**SYMBOL**	**QTY.**	**DESCRIPTION / FUNCTION**
1	C1,C3,C10,C12,C13,C14,C15,C61,C68,C74,C79,C82,C86,C90,C93,C101,C102,C109,C110,C114,C115,C117,C121,C122,C126,C133,C135,C138,C139,C140,C141,C145,C146,C147,C148,C149,C150,C151,C152,C162,C166,C167,C171,C172,C173,C183,C184,C188,C189,C190,C191,C192,C195,C196,C200	55	CAP 100nF, 16VDC, 20% 0603 X7R MLCC
2	C2,C11,C20,C35,C36,C37,C38,C39,C40,C41,C42,C43,C44,C45,C52,C54,C56,C67,C104	19	CAP 1.00uF, 50VDC, 20% 0805 X7R MLCC
3	C4,C5,C8,C9,C21,C22,C23,C24,C25,C26,C27,C28,C29,C30	14	CAP, Nichicon UD series 220uF 50V Electrolytic Capacitor, "UWD1H221MNL1GS"
4	C16,C46,C47,C48,C49,C50,C51,C53,C55,C60,C123,C153,C154,C155,C156,C157,C158,C159,C160,C161,C164,C165,C178,C179,C185,C186,C199	27	CAP 10.0nF, 50VDC, 20% 0603 X7R MLCC
5	C31,C62,C63,C65,C66	5	CAP, Nichicon UD series 100uF 35V Electrolytic Capacitor, "UWD1V101MNL1GS"
6	C57,C58,C76,C96,C97,C105,C112	7	CAP 10.0uF, 16VDC, 20% 1206 X7R MLCC
7	C59	1	CAP 47.0nF, 50VDC, 20% 0603 X7R MLCC
8	C64,C69,C71,C83,C84,C85,C89,C108,C113,C116,C118,C125,C131,C136,C137,C142,C163,C170,C194,C197,C198	21	CAP 470nF, 16VDC, 20% 0805 X7R MLCC
9	C80,C81	2	CAP 22.0pF, 50VDC, 5% 0603 C0G/NPO MLCC
10	C91,C95,C106,C107	4	CAP 330pF, 50VDC, 5% 0603 C0G/NPO MLCC
11	C92,C94,C98,C103	4	CAP 680pF, 50VDC, 5% 0603 C0G/NPO MLCC
12	C99,C119,C130,C134	4	CAP 68.0pF, 50VDC, 5% 0603 C0G/NPO MLCC
13	C143,C144	2	CAP 1.00uF, 16VDC, 20% 0805 X7R MLCC
14	C168,C169	2	CAP 1.00uF, 50VDC, 20% 1206 X7R MLCC
15	C174,C177	2	CAP 1.00uF, 50V DC, 20% 0603 X6S MLCC
16	C175,C176	2	CAP 10.00nF, 50V DC, 20% 0603 X7R MLCC
17	C180	1	CAP 0.01uF, 16VDC, 20% 0805 X7R MLCC
18	C181,C182,C187,C193	4	CAP 0.1uF, 50V DC, 20% 0603 X7R MLCC
19	D3,D13,D17,D26,D27,D32,D33,D35,D48,D51,D56,D64,D65,D67,D69,D71,D74,D76,D78	19	LED, Red DIffused 2.00V 20mA, "CMD15-21VRD/TR8"
20	D4,D5,D6,D7,D8,D9,D10,D11,D12,D18,D31,D34	12	Diode, 400V Peak Reverse Voltage SMC package
21	D19,D20,D21,D22,D23,D24,D36,D37,D38,D39,D41,D42,D43,D44,D66,D68,D70,D72,D73,D75,D77,D79,D80,D81,D82,D83,D84,D85,D86,D87,D88,D89,D90,D91,D92	35	Diode, General Purpose 1N4148 75V 200mA Diode 0603 PKG

ITEM #	SYMBOL	QTY.	DESCRIPTION / FUNCTION
22	D25,D40,D45,D46	4	Diode, ON Semi 60V 3A Schottkey Diode, MBRS360T3G
23	D47,D50,D53,D54,D57	5	LED, Green DIffused 2.10V 20mA, "CMD15-21VGD/TR8"
24	D49	1	LED, Yellow DIffused 2.00V 20mA, "CMD15-21VYD/TR8"
25	J1	1	Phoenix Mini 6-Pin Vert Thru-Hole Reflow Connector "MCV 1,5/6-G-3,81"
26	J2,J16	2	Phoenix 3-Pin Vert Thru-Hole Reflow Connector "CCVA 2,5/3-G-5,08P26THR"
27	J3	1	Phoenix 5-Pin Vert Thru-Hole Reflow Connector "CCVA 2,5/5-G-5,08P26THR"
28	J4	1	CONECTOR, Tyco AMPMOD2 6-pin Non-ROHS connector, "102202-3"
29	J5,J6	2	CONNECTOR, AMP 14-Pin Shrouded Right-Angle Header High-Temp Pin-In-Paste, N3314-5002RB
30	J7,J10	2	CONECTOR, Tyco AMPMOD2 5-pin Non-ROHS connector
31	J8	1	Phoenix MiniCombicon 4-Pin Vert Thru-Hole Reflow Connector "MCV 1,5/4-G-3,81 THT"
32	J9	1	Phoenix 8-Pin Vert Thru-Hole Reflow Connector "CCVA 2,5/8-G-5,08P26THR"
33	J11	1	HEADER, 3M 20-Pin Straight High-Temp Pin-In-Paste, N3428-6502RB
34	J12,J13,J20	3	HEADER, AMP 26-PIN Straight High-Temp Pin-In-Paste, N3429-6002RB
35	J14,J15,J17,J19	4	CONNECTOR, Phoenix Minicombicon 3-Pos ROHS Pin-In-Paste Reflow, "1937619"
36	J18	1	Phoenix Mini 10-Pin Vert Thru-Hole Reflow Connector "MCV 1,5/10-G-3,81P26THR"
37	L1,L2	2	INDUCTOR, Coilcraft 150uH 216mOhm 1.20Arms, "MSS1260-154KL"
38	L3	1	INDUCTOR, Coilcraft MSS1278 series 27uH 45mOhm 2.6Arms, "MSS1278-273ML"
39	L4	1	INDUCTOR, Coilcraft MSS1260 series 82uH 132mOhm 1.60Arms, "MSS1260-823ML"
40	L5	1	Inductor, muRata LQH32C_53 series chip inductor 1210 package, LQH32CN470K53L
41	MH1,MH2	2	Mounting Hole
42	Q1	1	Transistor, SMT Version of 2N3904 NPN in SOT23 Package
43	RN3,RN4,RN5,RN7,RN9,RN10,RN11,RN12,RN13,RN14,RN15	11	RES NET, 16 PIN SMT, "742C163103"

ITEM #	SYMBOL	QTY.	DESCRIPTION / FUNCTION
44	RT1	1	Thermistor 12k NTC 0805
45	R1,R2,R3,R4,R5,R6,R7,R8,R9,R10,R11,R12,R13,R14,R15,R16,R17,R18,R19,R20,R21,R22,R23,R24	24	RES 1.00 1% SMT 1206 PKG, THICK FILM
46	R25,R33,R38,R45,R112,R147,R165,R185	8	RES 1.80K 1% SMT 0603 PKG, THICK FILM
47	R26,R66,R106,R113,R119,R125,R138,R139,R152,R153,R161,R162,R176,R186,R204,R205,R207,R208,R210,R211,R213,R214,R253,R254,R259,R262,R271,R273,R274,R279,R292,R293	32	RES 10.0K 1% SMT 0603 PKG, THICK FILM
48	R27,R28,R29,R30,R31,R32,R39,R40,R41,R42,R43,R44,R263,R264,R265,R266,R281,R282,R284,R285,R297,R298	22	RES 680 1% SMT 1206 PKG, THICK FILM
49	R34,R62,R65,R68,R69,R72,R75,R78,R79,R80,R129,R142,R180,R189,R203,R206,R209,R212,R228,R233,R238,R243,R269,R270,R289,R290,R301	27	RES 1.00K 1% SMT 0603 PKG, THICK FILM
50	R35,R60,R257	3	RES 15.0K 1% SMT 0603 PKG, THICK FILM
51	R36,R61,R63,R124,R131,R154,R191,R216,R222	9	RES 2.70K 1% SMT 0603 PKG, THICK FILM
52	R37,R92,R94,R97,R121,R123,R198,R200	8	RES 3.30K 1% SMT 0603 PKG, THICK FILM
53	R46,R47,R48,R49,R50,R51,R52,R53,R54,R55,R56,R57,R58,R59,R132,R133,R148,R149,R158,R170,R171,R172	22	RES 270 1% SMT 0603 PKG, THICK FILM
54	R64,R95,R98,R122,R144,R163,R199,R225,R230,R236,R241	11	RES 180 1% SMT 0603 PKG, THICK FILM
55	R67	1	RES 680 1% SMT 0603 PKG, THICK FILM
56	R70,R71,R73,R74,R76,R77,R226,R231,R235,R240,R267,R268,R287,R288,R300	15	RES 560 1% SMT 0603 PKG, THICK FILM
57	R81,R82,R83,R84,R85,R86,R87,R88,R89	9	RES 68.0 1% SMT 0603 PKG, THICK FILM
58	R90,R91	2	RES 33.0K 1% SMT 0603 PKG, THICK FILM
59	R93,R111,R140,R187,R196	5	RES 47.5K 1% SMT 0603 PKG, THICK FILM
60	R96	1	RES 3.90K 1% SMT 0603 PKG, THICK FILM
61	R99	1	RES 330 1% SMT 0603 PKG, THICK FILM
62	R103,R104	2	RES 180 1% SMT 1206 PKG, THICK FILM
63	R105,R114,R116,R120,R126,R127,R141,R143,R178,R179,R181,R197,R202	13	RES 5.60K 1% SMT 0603 PKG, THICK FILM
64	R107,R108,R109,R110	4	POT, muRATA 3mm 1k sealed trimmer pot, "PVG3A102C01R00"
65	R115,R117,R135,R136,R155,R156,R166,R167	8	RES 3.30 1% SMT 1206 PKG, THICK FILM
66	R118	1	Ignore, This is a virtual nonexistant part
67	R128,R130,R188,R190	4	RES 1.20K 1% SMT 0603 PKG, THICK FILM
68	R137,R146,R164,R177	4	RES 6.80K 1% SMT 0603 PKG, THICK FILM
69	R192	1	RES 12.1K 1% SMT 0603 PKG, THICK FILM

ITEM #	SYMBOL	QTY.	DESCRIPTION / FUNCTION
70	R201,R272,R275,R276	4	RES 1.50K 1% SMT 0603 PKG, THICK FILM
71	R215	1	RES 27.0K 1% SMT 0603 PKG, THICK FILM
72	R217,R218	2	RES 270 1% SMT 1206 PKG, THICK FILM
73	R224,R227,R229,R232,R234,R237,R239,R242	8	RES 470 1% SMT 0603 PKG, THICK FILM
74	R244,R245	2	RES 120 1% SMT 0603 PKG, THICK FILM
75	R255,R256,R277,R278	4	RES 2.0K 1% SMT 0603 PKG, THICK FILM
76	R258	1	RES 37.4K 1% SMT 0603 PKG, THICK FILM
77	R260,R261,R283,R286,R299	5	RES 270 1% SMT 0603 PKG, THICK FILM
78	R280	1	RES 120 1% SMT 0603 PKG, THICK FILM
79	R291,R295	2	RES 20.0K 1% SMT 0603 PKG, THICK FILM
80	R294,R296	2	RES 20.0K 1% SMT 0603 PKG, THICK FILM
81	SW1,SW2,SW3,SW4	4	OMRON HEX 6-pin Rotary SMT DIP switch "A6RS-162RF-P"
82	SW5	1	SWITCH SLIDE DPDT 6VDC 0.3A SMT
83	TP1,TP2,TP3,TP4,TP5,TP6,TP7,TP8,TP9,TP10,TP11,TP12,TP13,TP14,TP15,TP16,TP17,TP18,TP19,TP20,TP21,TP22,TP23,TP24,TP25,TP26,TP27,TP28,TP29,TP30,TP31,TP32,TP33,TP34	34	TEST POINT, Keystone Miniature SMT Test Point, "5015"
84	U1	1	I.C., 3V-5.5V TSSOP RS-232 Driver/Receiver, "SN75C3221EPW"
85	U2,U6,U7,U8	4	I.C., National 500kHz Buck Converter, "LM22676TJ-ADJ"
86	U3,U4,U5,U43,U44,U45	6	OPTOCOUPLER, Vishay Dual 4kV ISO CTR 63%-125%, ILD206T
87	U9	1	ON Semiconductor Voltage Regulator, -15V 1A Rating, "MC7915CD2TR4G"
88	U10,U11,U20	3	ON Semiconductor Darlington Transistor Array, 7 Transistor Pairs, "MC1413DR2G"
89	U12,U24,U25	3	ON Semi, QUAD NAND Gate SOIC, MC74LCX00D
90	U13	1	ON Semiconductor 3.3V CMOS Hex Inverter, "MC74AC05DR2"
91	U14	1	ON Semiconductor 3.3V 1.0A LDO SOT223 Regulator, "NCP1117ST33T3G"
92	U15,U18	2	I.C., Dual 4-to-1 multiplexor SOIC, "SN74HC153D"
93	U16	1	IC 8-pin SOIC package, SPI EEPROM, 256Kbits.
94	U17	1	Microchip 16-bit DSP "dsPIC33FJ16GS504I/PT"
95	U19	1	Microchip 16-bit DSP "dsPIC33FJ256GP710PF"
96	U21,U23	2	TI 6.4MHz Rail-Rail JFET Low Voltage OPAMP, "TLV2464AIDR"

ITEM #	SYMBOL	QTY.	DESCRIPTION / FUNCTION
97	U22	1	TI 150mA 3.3V LDO 30mV dropout, "TPS73133DBVRG4"
98	U26,U27	2	DIGITAL ISOLATOR, Analog Devices 100-Mbit digital isolator
99	U28,U29	2	I.C. TI Dual Positive Edge Flip-Flops, SN74AC74D
100	U30,U31	2	CONV, Murata 3kV isolation 5V/5V DC/DC Converter
101	U32,U33,U34,U35	4	OPAMP, TI Rail-To-Rail Fully Differential OpAmp, THS4521ID
102	U36	1	TI, Quad Differential Line Receiver, SN65LVDS048A
103	U37,U39,U40	3	TI, Quad Differential Line Driver SOIC, SN65LVDS047D
104	U38,U41	2	NXP 5V HS CAN driver, PCA82C251TD-T
105	U42	1	National Semiconductor Frequency to Voltage Converter
106	Y1	1	CRYSTAL10.0000MHz 18pF SMD

PCB2 Driver Board (0558038382)

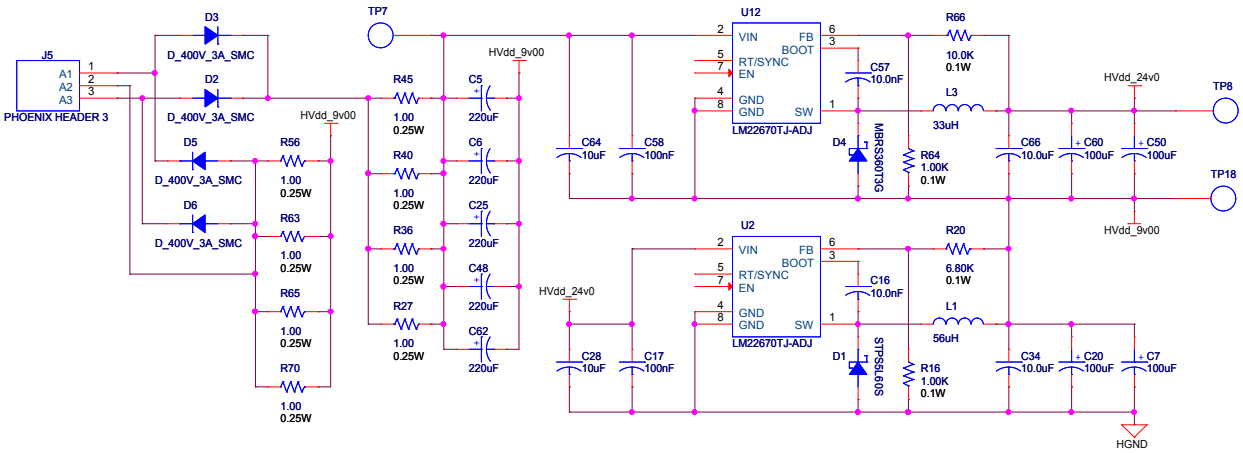
The driver board (PCB2) is used to (a) filter and condition the IGBT gating signals, (b) scale down the bus voltage and output (Arc) voltage signals.

Refer to Appendix B for complete schematics.

The IGBT gating signals are filtered and conditioned to reduce noise and stray voltages that could damage the IGBTs. These signals are distributed to each of the two IGBTs. The driver board receives IGBT gating pulses and command signals from the control board PCB1.

PCB2 Bias Supply

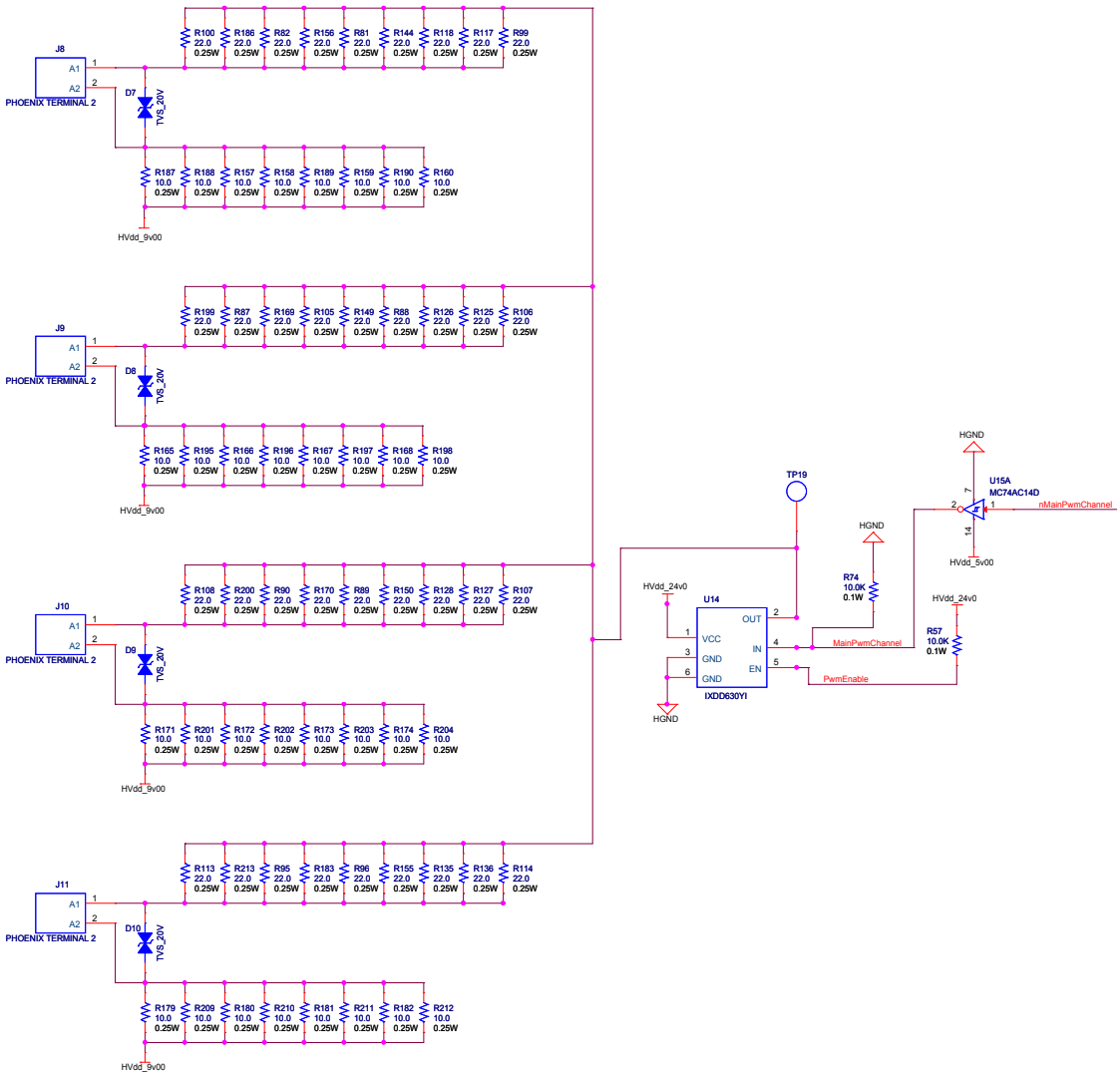
The driver board has bias supply built onboard to power its own circuitry. The board receives 24 VAC from the control transformer (TB3-1 and TB3-2) on pins 1 and 3 of connector J5. This AC voltage is rectified through a diode bridge rectifier (D2, D3, D5, and D6) and filtered by a capacitor. The filtered DC voltage is fed through a regulator U12 to have a regulated 24 VDC bias supply. This 24 VDC is used to power the circuits requiring 24 volts bias supply. The filtered DC from the rectifier bridge and capacitor filter is fed through resistor voltage divider to have 9 VDC bias supply which powers the circuits requiring the 9 volts supply. This 9 VDC is fed through U6 to have 5 VDC which is used for the IGBT gating pulses.



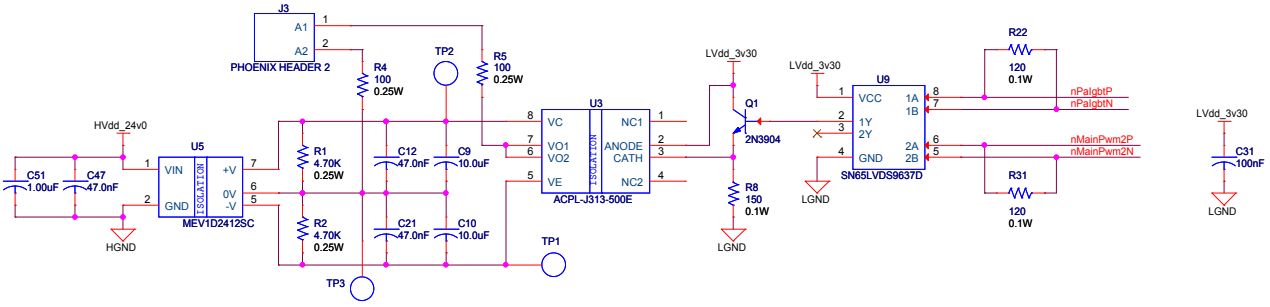
PCB2 Driver board also gets 5 VDC and 3.3 VDC from Control Board (PCB1) via ribbon cable connector to have same common for the analog signals (voltage and differential PWM pulses).

PCB2 PWM Pulse Circuit

Main IGBTs:
The pulse circuit accepts the pulses from the control board (PCB1) and then isolates them through opto-coupler. In this way, the control board is isolated from the IGBTs and the gating pulses will have sufficient drive current to push the IGBTs. The pulses from the control board are sent via ribbon cable connector as low voltage (3.3 VDC) differential signals which are combined together and isolated to form high voltage (5.0 VDC) PWM pulse signal. These PWM signals are fed to IGBT gate driver U14. U14 is 24 VDC bias supplied IC which will output 24 VDC PWM pulses corresponding to the PWM pulses from the control board. In EPP-202 all the IGBTs, connected to J8, J9, J10 and J11, are operated in parallel for either cutting or marking with a variable frequency ranging from 15KHz – 25 KHz.



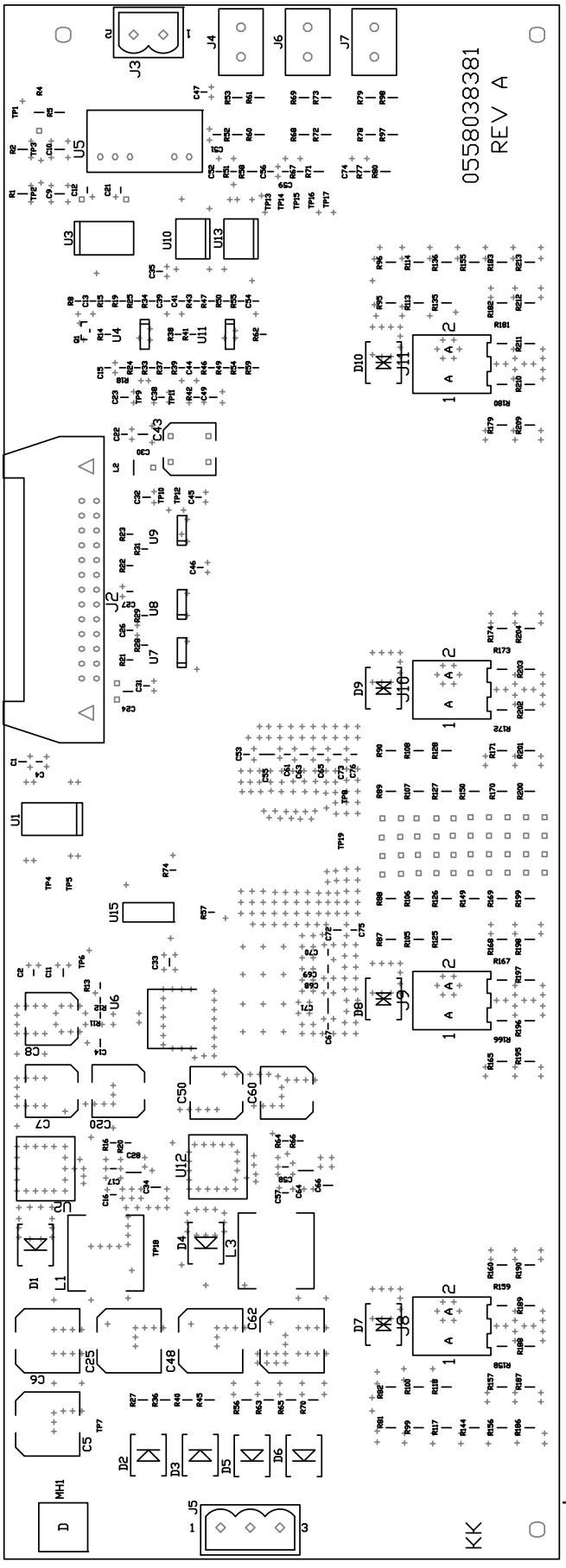
Pilot Arc IGBT:
Pulse circuit accepts the low voltage (3.3 VDC) differential PWM pulses from control board, are combined together and isolated to form high voltage (5.0 VDC) PWM pulses. These pulses are fed to Pilot Arc IGBT (Q5) connected to J3.



PCB2 Test Points

Test Point	Expected Value	Signal	Function
TP1	-12 VDC	-V	Negative 12 VDC bias supply
TP2	+12 VDC	+V	12 VDC bias supply
TP3	0 VDC	0V	0 VDC reference
TP4		nRefPwmChannel	Reference PWM signal
TP5		nMainPwmChannel	Main PWM signal for IGBTs
TP6	0 VDC	HGND	3.3 VDC digital bias supply for micro
TP7	45 VDC		Rectified Unregulated Voltage
TP8	+24 VDC	HVdd_24v0	24 VDC bias supply
TP9	5 VDC	ALVdd_5v00	5 VDC low voltage analog bias supply
TP10	3.3 VDC	LVdd_3v30	3.3 VDC low voltage bias supply
TP11	0 VDC	ALGND	Analog Common Reference
TP12	0 VDC	LGND	Analog Common Reference
TP13		VARC(-)	Arc Voltage measuring point
TP14		VWORK(+)	Work Common Reference
TP15		VBUS(-)	Bus voltage measuring reference
TP16	5 VDC	HVdd_5v00	High voltage 5 VDC bias supply
TP17	0 VDC	HGND	High voltage circuitry common reference
TP18	+9 VDC	HVdd_9v00	9 VDC bias supply
TP19	Pulse Signals	PWM OUT	PWM Signals to IGBTs

PCB2 Layout (0558038381)



PCB2 BOM (0558038382)

0558038382 Driver Board Component List			
ITEM	**SYMBOL**	**QTY**	**DESCRIPTION**
1	C1,C23,C32,C49	4	CAP 470nF, 16VDC, 20% 0805 X7R MLCC
2	C2,C4,C15,C22,C26,C27,C31,C35,C38,C44,C45, C46,C56	13	CAP 100nF, 16VDC, 20% 0603 X7R MLCC
3	C5,C6,C25,C48,C62	5	CAP, Nichicon UD series 220uF 50V Electrolytic Capacitor, "UWD1H221MNL1GS"
4	C7,C8,C20,C43,C50,C60	6	CAP, Nichicon UD series 100uF 35V Electrolytic Capacitor, "UWD1V101MNL1GS"
5	C9,C10,C24,C30,C34,C66	6	CAP 10.0uF, 16VDC, 20% 1206 X7R MLCC
6	C11	1	CAP 1.00uF, 16VDC, 20% 0805 X7R MLCC
7	C12,C21,C47	3	CAP 47.0nF, 50VDC, 20% 0603 X7R MLCC
8	C13,C16,C39,C41,C52,C54,C57,C59,C74	9	CAP 10.0nF, 50VDC, 20% 0603 X7R MLCC
9	C14,C33,C51,C69,C72,C73	6	CAP 1.00uF, 50VDC, 20% 0805 X7R MLCC
10	C17,C58	2	CAP 100nF, 50VDC, 20% 0603 X7R MLCC
11	C28,C55,C64,C71	4	CAP 10uF, 50VDC, 20% 1210 X7S MLCC
12	C53,C61,C65,C67,C68,C70,C75,C76	8	CAP 68.0nF, 50VDC, 20% 0603 X7R MLCC
13	C63	1	CAP 1.00uF, 50VDC, 20% 0805 X7R MLCC
14	D1	1	Diode, ST Microelectronics 60V 5A Schottkey Diode
15	D2,D3,D5,D6	4	Diode, 400V Peak Reverse Voltage SMC package
16	D4	1	Diode, ON Semi 60V 3A Schottkey Diode, MBRS360T3G
17	D7,D8,D9,D10	4	20V 1500W Transient Voltage Suppressor
18	J2	1	HEADER, AMP 26-PIN Straight High-Temp Pin-In-Paste, N3429-6502RB
19	J3	1	Phoenix 2-Pin Vert Thru-Hole Reflow Connector "CCVA 2,5/2-G-5,08P26THR"
20	J4,J6,J7	3	FASTON, 1/4" Faston Blade
21	J5	1	Phoenix 3-Pin Vert Thru-Hole Reflow Connector "CCVA 2,5/3-G-5,08P26THR"
22	J8,J9,J10,J11	4	Termina, Phoenix 2 Connector 55-deg Terminal

ITEM	SYMBOL	QTY	DESCRIPTION
23	L1	1	INDUCTOR, Coilcraft MSS1278 series 56uH 81mOhm 1.9Arms
24	L2	1	Inductor, muRata LQH32C_53 series chip inductor 1210 package, LQH32CN470K53L
25	L3	1	INDUCTOR, Coilcraft MSS1278 series 33uH 61.9mOhm 2.3Arms, "MSS1278-333ML"
26	MH1	1	Mounting Hole
27	Q1	1	Transistor, SMT Version of 2N3904 NPN in SOT23 Package
28	R1,R2	2	RES 4.70K 1% SMT 1206 PKG, THICK FILM
29	R4,R5	2	RES 100 1% SMT 1206 PKG, THICK FILM
30	R8	1	RES 150 1% SMT 0603 PKG, THICK FILM
31	R11,R18,R21,R22,R23,R24,R28,R29,R31,R33,R37, R46,R49,R54,R59	15	RES 120 1% SMT 0603 PKG, THICK FILM
32	R12	1	RES 330 1% SMT 0603 PKG, THICK FILM
33	R13	1	RES 33.0 1% SMT 0603 PKG, THICK FILM
34	R14,R38,R41,R57,R62,R66,R74	7	RES 10.0K 1% SMT 0603 PKG, THICK FILM
35	R15,R19,R25,R34,R43,R47,R50,R55	8	RES 2.20K 1% SMT 0603 PKG, THICK FILM
36	R16,R64	2	RES 1.00K 1% SMT 0603 PKG, THICK FILM
37	R20	1	RES 6.80K 1% SMT 0603 PKG, THICK FILM
38	R27,R36,R40,R45,R56,R63,R65,R70	8	RES 1.00 1% SMT 1206 PKG, THICK FILM
39	R32	1	Ignore, This is a Virtual Non-Existant Part
40	R39,R42	2	RES 2.70K 1% SMT 0603 PKG, THICK FILM
41	R51,R67,R77	3	RES 221 1% SMT 0603 PKG, THICK FILM
42	R52,R53,R58,R60,R61,R68,R69,R71,R72,R73,R78, R79,R80,R97,R98	15	RES 100K 1% SMT 1206 PKG, THICK FILM
43	R81,R82,R87,R88,R89,R90,R95,R96,R99,R100,R1 05,R106,R107,R108,R113,R114,R117,R118,R125, R126,R127,R128,R135,R136,R144,R149,R150,R1 55,R156,R169,R170,R183,R186,R199,R200,R213	36	RES 22.0 1% SMT 1206 PKG, THICK FILM
44	R157,R158,R159,R160,R165,R166,R167,R168,R1 71,R172,R173,R174,R179,R180,R181,R182,R187, R188,R189,R190,R195,R196,R197,R198,R201,R2 02,R203,R204,R209,R210,R211,R212	32	RES 10.0 1% SMT 1206 PKG, THICK FILM

ITEM	SYMBOL	QTY	DESCRIPTION
45	TP1,TP2,TP3,TP4,TP5,TP6,TP7,TP8,TP9,TP10,TP11,TP12,TP13,TP14,TP15,TP16,TP17,TP18,TP19	19	TEST POINT, Keystone Miniature SMT Test Point, "5015"
46	U1	1	I.C. Quad CMOS Digital Isolator 4kV isolation, ISO7241MDW
47	U2,U12	2	I.C., National 500kHz 3.0A Buck Converter
48	U3	1	I.C. Avago Isolated Gate Driver 2.5A 3.75kVrms Breakdown SMT, ACPL-J313-500E
49	U4,U11	2	OPAMP, TI Rail-To-Rail Fully Differential OpAmp, THS4521ID
50	U5	1	CONV MUrATA 3kVDC isolation 24V/+-12V DC/DC Converter
51	U6	1	PWR Supply, National 1.5A TO-263 Adjustable Voltage Regulator, "LM1086CS-ADJ"
52	U7,U9	2	I.C. TI Dual Differential Line Receiver, SN65LVDS9637D
53	U8	1	I.C. TI Differential Driver and Receiver Pair, SN65LVDS179D
54	U10,U13	2	I.C., Avago Sigma-Delta Analog Isolator, 5kVrms Isolation, ACPL-C784
55	U14	1	I.C., IXYS 30A Low Side Ultrafast MOSFET/IGBT Driver
56	U15	1	INVERTER, ON Semi Schmitt Input HEX SOIC NOT Gate

TROUBLESHOOTING

Troubleshooting

WARNING

ELECTRIC SHOCK CAN KILL!
DO NOT PERMIT UNTRAINED PERSONS TO INSPECT OR REPAIR THIS EQUIPMENT. ELECTRICAL WORK MUST BE PERFORMED BY AN EXPERIENCED ELECTRICIAN.

CAUTION

Stop work immediately if power source does not work properly.
Have only trained personnel investigate the cause.
Use only recommended replacement parts.

Check the problem against the symptoms in the following troubleshooting guide. The remedy may be quite simple. If the cause cannot be quickly located, shut off the input power, open up the unit, and perform simple visual inspection of all the components and wiring. Check for secure terminal connections, loose or burned wiring or components, bulged or leaking capacitors, or any other sign of damage or discoloration.

The cause of control malfunctions can be found by referring to the sequence of operations, electrical schematics and checking the various components. A volt-ohmmeter will be necessary for some of these checks.

Troubleshooting Guide

When the input power is applied to EPP-362 power source, pump motor should turn ON immediately, the power light on the front panel will be ON and fault light will be OFF (if there are no errors/faults) indicating normal operation.
Check the following:

1. If pump motor doesn't turn ON, fuse(F3) might be bad or check for a bad connection to pump motor.
2. If POWER light doesn't turn ON or main contactor and main fan doesn't turn ON, then it could be caused by blown fuses F1 or F2.
3. If the FAULT light is ON, then check the CNC/Process Controller display screen for the type of error message from power source.

Fault Light, Main Contactor and Main Fan status for different errors/faults:

Type of Fault	Fault Light Status	Fault Light Frequency	K1 and Main Fan Status
Thermal or Ambient	**ON**	Continuous	**ON**
Servo Fault	**TOGGLE**	50% duty cycle with a period of 1 second	**OFF**
All other Faults	**TOGGLE**	50% duty cycle with a period of 2 seconds	**OFF**

TROUBLESHOOTING

Help Codes

When fault light is in either one of the above-mentioned states, check the CNC/Process Controller screen for the complete description of the error.
The list of errors with detail description for the power source are shown in the table below.

Error code	**Problem**	Solution
01	Supply Line Voltage exceeded or dropped below + / - 15% of rated input when machine is in Idle mode	1. Check the input voltage to the machine with a voltage meter. 2. Check the input power cable for correct size and resistance. 3. Check the Main Transformer (T1) voltage tapping connections. 4. Check the input fuses in the PS. 5. Check the input line fuses in the disconnect box. 6. Check the multi-color ribbon cable between J12 on PCB1 and J2 and PCB2.
02	Supply Line Voltage exceeded or dropped below + or - 20% of rated input while cutting	1. Check the input line voltages to the machine with a voltage meter. 2. Check the input power cable for correct size and resistance. 3. Check the Main Transformer (T1) voltage tapping connections. 4. Check the input fuses in the PS. 5. Check the input line fuses in the disconnect box. 6. Check the multi-color ribbon cable between J12 on PCB1 and J2 and PCB2. 7. Notify your power company of the line stiffness issues.
03	Control Transformer not supplying proper voltage to control board or the +24 and +/-15 volt bias supplies are not balanced	1. Check the input voltage taps on the control transformer. 2. Check the control transformer output voltages on TB3, if the voltages read within +/-15% of the specified value then replace the control board else replace control transformer.
04	There is a thermal fault inside the power supply. Fix any coolant flow errors before investigating this error.	1. Wait 10 minutes for the unit to cool. If the thermal fault clears on its own then check for the ambient temperature being above 40C or dirt in the radiators. 2. Check if main fan is functioning and it is pulling air through the power supply. 3. Shut off the power supply and allow the machine to cool. 4. Check the diode bridge for an open thermal switch. If the switch is still open after certain time then replace the switch. 5. Check the IGBT module for an open thermal switch. If the switch is still open after certain time then replace the switch.
05	CYCLE START signal is high while the power source is booting up.	1. Check the start signal to the power supply while the power supply is OFF. If there is voltage on the input, find and fix the wiring error. 2. Check the start signal to the power supply while the power supply is ON. If there is voltage on the input while CNC is OFF, check the power supply control wiring for a short to the input.
06	Failed to fire/ ignition did not take place within 4 seconds after HF is turned ON.	1. Check the distance from the work piece matches the recommended ignition height. 2. Check the electrical connection from the work piece to the work connection on the power supply. 3. Check the HF relay inside the power supply. 4. Check the 115VAC voltage on the control transformer. 5. Check the consumables.
08	Torch error/Electrode current was present before the PWM was enabled.	1. Check the jumper inside the RAS box between pins L and J on the 14-pin Amphenol connector. 2. Check for short between electrode and nozzle. 3. Check the IGBT gate pulse voltage connection on the driver board. 4. Check for shorted IGBT. 5. Check for shorted diode (D9).
09	Arc voltage is greater than 40V in Idle mode.	1. Check for shorted IGBT. 2. Check for shorted diode (D9). 3. Check the arc voltage feedback connection on the driver board from the Electrode (-) terminal. 4. Check IGBT gate pulse voltage connection on the driver board.
11	Output current is greater than the minimum idle current.	1. Check for shorted IGBT. 2. Check for shorted diode (D9). 3. Check the IGBT gate pulse voltage connection on the driver board. If there is positive voltage then replace the driver board. 4. Check the hall sensors and their connections to the control board. 5. Replace the control board.
12	A phase of the input power is missing.	1. Check the fuses in the disconnect box for bad fuse. 2. Check the main contactor contacts for any damage. 3. Verify the input to the power supply is providing all 3 phases.
13	Open circuit voltage did not reach 280 volts within 200 msec.	1. Check for short between the electrode and nozzle. 2. Check for short between the electrode cable and a connection to the work output of the power supply. 3. Check for an open IGBT. 4. Check the IGBT gate pulse voltage connection on the driver board. 5. Check the multi-color ribbon connection from J12 on PCB1 to J2 on PCB2.
14	Ambient temperature exceeded 75° C in control enclosure.	1. Check the temperature inside the control panel, if it reads below 55C and still the error is present then replace the control board. 2. Cool the area around the power supply to below 40C. This is the upper limit of the rated operating range for the power supply.
15	Bus voltage failed to reach 200 VDC with in 500 ms.	1. Check for faulty input fuse. 2. Check for shorted bus filter capacitor. 3. Check the bus charger contactor (K2) contacts and coil for any damage. 4. Check the bus-charger contactor relay (RB1-1) for failure. 5. Check bus charger resistors connections. 6. Check the ribbon cable connection between J6 and Relay Module (RB1). 7. Check the multi-color ribbon cable connection between J12 on PCB1 to J2 on PCB2. 8. Check the 24VAC supply on the control transformer.

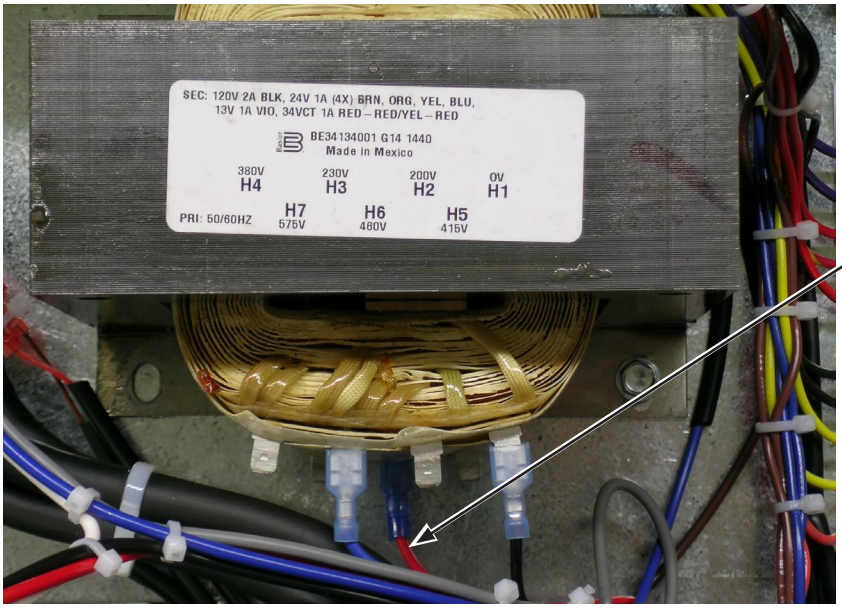
18	Output voltage fell below 70 volts during cutting or below 40 volts during marking.	1. Check for short in the torch cable. 2. Check cutting or marking height is too low. 3. Check for short between electrode and nozzle. 4. Check for short between Work (+) and Electrode (-) terminals on the power supply. 5. Check for coiled or looped up electrode or work cables.
20	Output or Arc voltage detected before START signal issued	1. Check for a shorted IGBT. 2. Check the gate pulse voltage to IGBT from driver board. If there is a positive voltage during idle, replace the driver board. 3. Check the IGBT gate pulse voltage connections and make sure they are as per schematics. 4. Check the arc voltage feedback connections on the driver board. 5. Check for shorted diode (D9). 6. Check the multi-color ribbon cable connection between J12 on PCB1 and J2 on PCB2.
21	Main contactor failed to engage or disengage.	1. Check the input fuses inside the disconnect box. 2. Check the main contactor (K1) contacts. 3. Check the main transformer auxiliary windings connection on TB2 for 115VAC. 4. Check the relay RB1-2 on the relay module RB1. 5. Check the ribbon cable connection between J6 and relay module RB1.
22	Work current is greater than Electrode current plus threshold limit during cutting.	1. Check the feedback from the hall sensors. 2. Check the connection from hall sensors to the control board. 3. Replace the control board.
23	The power supply enable signal is missing.	1. Check the power supply enable signal is present. This should be a dry contact output from the CNC. 2. Check for the power supply enable signal going to J1 connector on PCB1. 3. Check the enable signal contacts on K4 relay. 4. Check control transformer 24VAC voltage on TB3 powering K4 and K5. 5. Replace the control board.
24	There was an SPI communication error between the main and servo micro on control board.	1. Shut off the power supply for at least 5 minutes. If the error clears, check the grounding of the machine and the power supply. 2. Replace the control board.
25	The EEPROM on the control has failed.	1. Shut off the power supply for at least 5 minutes. If the error clears, check the grounding of the machine and the power supply. 2. Replace the control board.
27	The servo and supervisor on the control board of the power supply has firmware version mismatch.	Replace the control board.
28	Jumper in the RAS box is missing.	1. Check the jumper inside the RAS box between pins L and J on the 14-pin Amphenol connector. 2. Check for damaged control cable. 3. Replace the control board.
30	The servo on the control board has fault.	1. Check for bad hall sensor. 2. Check for diode (D9) connection on the IGBT module bus bars. 3. Shut off the power supply for at least 5 minutes. If the error clears, check the grounding of the machine and the power supply. 4. Replace the control board.
31	Coolant flow is below 0.45GPM.	1. Check the coolant level. 2. Check for a clogged filter. 3. Check for leaks in the coolant return line. 4. Check the bypass regulator for bypassing too much coolant. 5. Check input power to the pump. 6. Check for proper pump function by looking for flow into the tank. If there is no flow and the motor in running, replace the pump head. 7. Check the connection of the flow sensor to the control board. 8. Check for the SW6 position set properly according the flow sensor either turbine flow or rotor flow sensor. 9. Replace the control board.
32	Coolant flow is above 2.4GPM.	1. Check the connection of the flow sensor to the control board. 2. Check for the SW6 position set properly according the flow sensor either turbine flow or rotor flow sensor. 3. Replace the control board.
33	There was a watchdog error on the CAN bus.	1. Check the CAN connection between the interface control and the power supply's control board. 2. Check the input power to the interface control. 3. Check for all the dip switches on the IC board are toward the display. 4. Check for SW5 on the control board in the power supply is set to "CLOSE". 5. Check for coiling of the CAN cable near power leads.
34	Ignition/Arc lost in dwell state immediately after it attached to the plate.	1. Check that the piercing distance of the torch is at the recommended level. 2. Check that the ignition distance of the torch is at the recommended level. 3. Check the consumables.
35	The station constant's CRC received from the controller did not match the calculated CRC.	This will normally correct itself, if not replace the control board.
39	Hall Sensor Connector is removed or jumper is missing.	1. Check the hall sensor feedback connector for proper wiring.

Input Voltage Configuration and Changeover

380 VAC, 400 VAC and 460 VAC Models - As shipped from the factory, these models of EPP-362 are configured for the single input voltage listed on the rating plate. If using other input voltages, it is possible to configure these units for 380 VAC, 400 VAC or 460 VAC input.

There are 3 steps to follow when making this conversion:

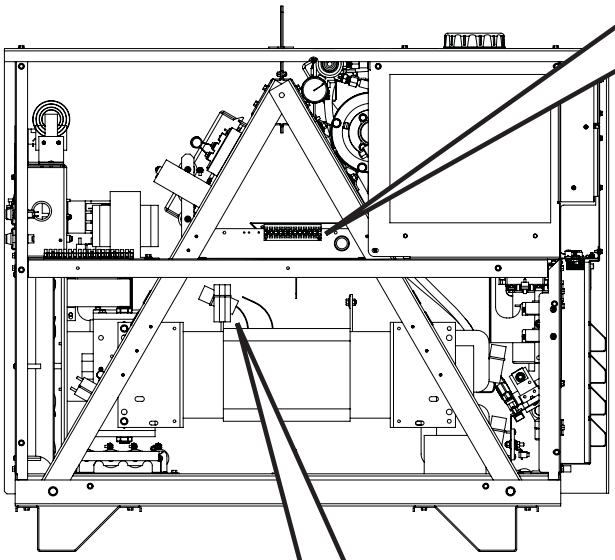
1. Reconfigure the voltage tap on the control transformer (T2) for the proper input voltage:

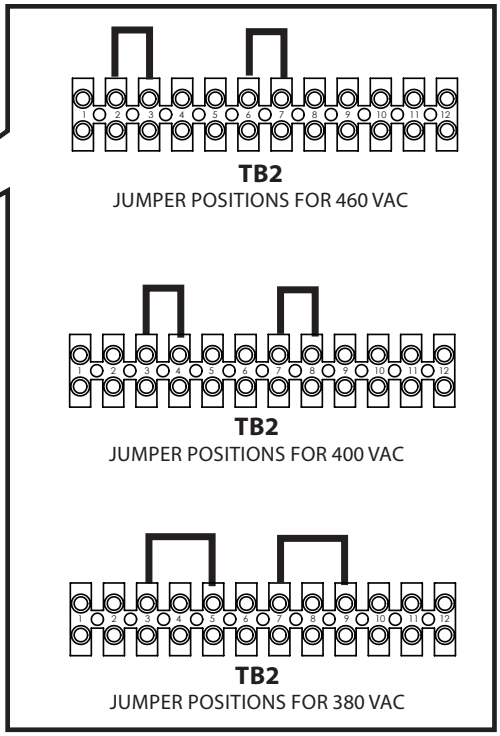


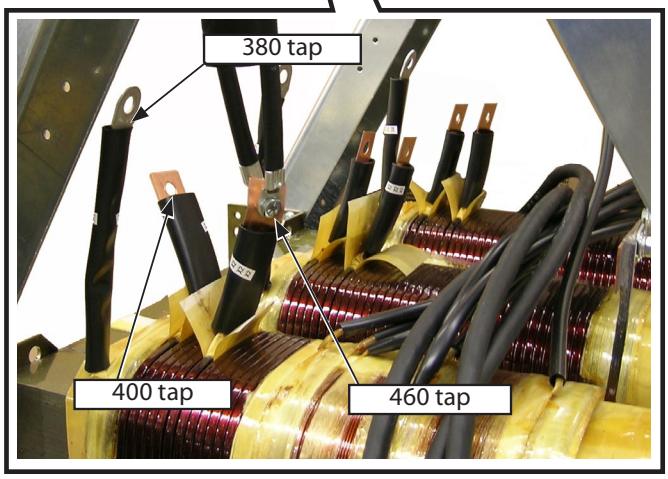
Move this wire connection to:
460 VAC - H6 (as shown)
400 VAC - H5
380 VAC - H4

380 VAC, 400 VAC and 460 VAC Models (continued) -

2. Reconfigure TB2 terminal strip for proper voltage.

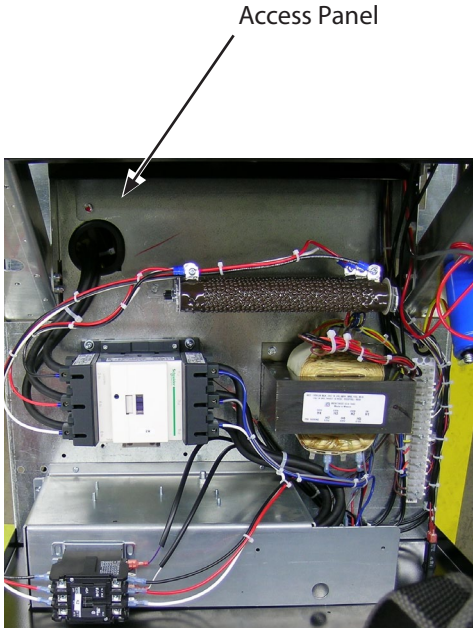






NOTE:
Wires connected on main transformer tap must be re-connected to 460, 400 or 380 main transformer taps on all 3 coils. Be sure to replace insulating vinyl covering over connections.

3. Reconfigure secondary taps on all three main transformer coils. A removable service panel is located above the transformer connections to improve access.



575 VAC Models - this model is not configurable to any other input voltage.

REPLACEMENT PARTS

Replacement Parts

General

Always provide the serial number of the unit on which the parts will be used. The serial number is stamped on the unit nameplate.

Ordering

To ensure proper operation, it is recommended that only genuine ESAB parts and products be used with this equipment. The use of non-ESAB parts may void your warranty.

Replacement parts may be ordered from your ESAB Distributor.

Be sure to indicate any special shipping instructions when ordering replacement parts.

Refer to the Communications Guide located on the back page of this manual for a list of customer service phone numbers.

NOTE:

Schematics and Wiring Diagrams on 279.4 mm x 431.8 mm (11″ x 17″) paper are included inside the back cover of this manual.

Refer to Appendix A for complete schematics.

Items listed in the assembly drawing Bill of Materials (included in the back of this publication) that do not have a part number shown are not available from ESAB as a replaceable item and cannot be ordered. Descriptions are shown for reference only. Please use local retail hardware outlets as a source for these items.

GENERAL INFORMATION

General Information

CAUTION

Voltages in plasma cutting equipment are high enough to cause serious injury or possibly death. Be careful around equipment when the covers are removed.

Maintenance

Maintenance
A maintenance schedule should be created and based on the following variables, amount of usage, placement of machine and cleanliness of local environment. A maximum time between should be no more the 90 days.

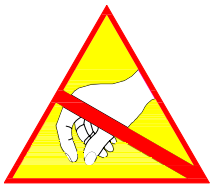
External: Check work cable for worn insulation and confirm tight electrical connections. Check safety ground ground at work piece and at power source. Check torch cables for worn insulation and confirm tight electrical connections. Drain any moisture from the bowl of the input filter / regulator.

Internal: Check for discolored connections as they indicate a loose connection. Check all plugs, fittings and electrical connections for tightness. Make sure cables and hoses are not damaged, flattened or kinked. With input power disconnected and wearing proper eye and face protection, blow out accumulated dirt and foreign materials for the inside of unit. Extra attention should be given to the finned heatsinks.

CAUTION

Water or oil occasionally accumulates in compressed lines. Be sure to direct the first blast of air away from the equipment to avoid damage to the Mm300X

Electrostatic Discharge



ESD

WARNING!

STATIC ELECTRICITY can damage circuit boards and electronic components.

- Observe precautions for handling electrostatic sensitive devices.
- Use proper static-proof bags and boxes.

What is ESD?

A sudden transfer or discharge of static electricity from one object to another. ESD stands forElectrostatic Discharge.

How does ESD damage occur?

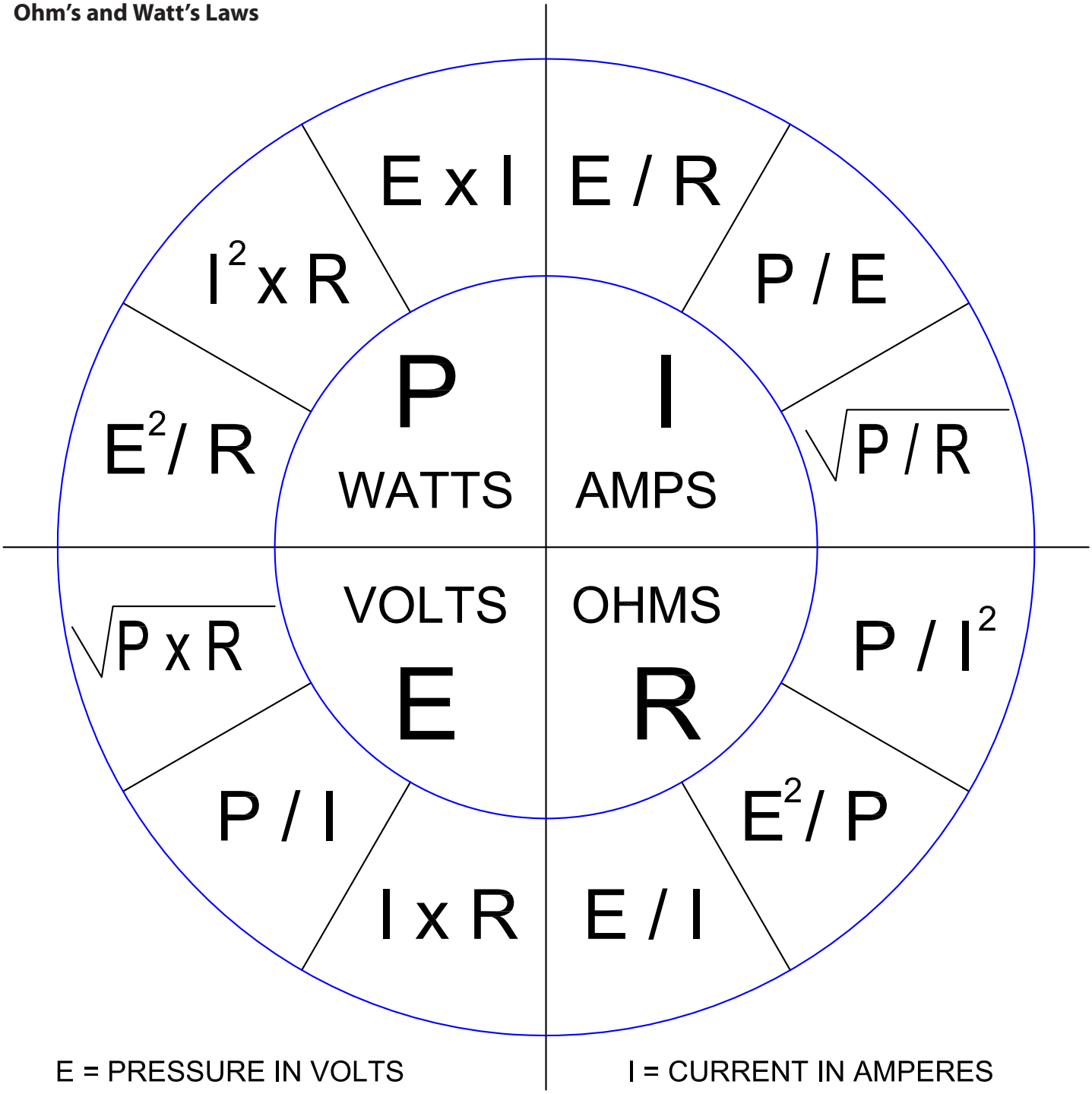
ESD can cause damage to sensitive electrical components, but is not dangerous to people.ESD damage occurs when an ungrounded person or object with a static charge comes intocontact with a component or assembly that is grounded. A rapid discharge can occur,causing damage. This damage can take the form of immediate failure, but it is more likelythat system performance will be affected and the component will fail prematurely.

How do we prevent ESD damage?

ESD damage can be prevented by awareness. If static electricity is prevented from buildingup on you or on anything at your work station, then there cannot be any static discharges.Nonconductive materials (e.g. fabrics), or insulators (e.g. plastics) generate and hold staticcharge, so you should not bring unnecessary nonconductive items into the work area. It is obviously difficult to avoid all such items, so various means are used to drain off anystatic discharge from persons to prevent the risk of ESD damage. This is done by simpledevices: wrist straps, connected to ground, and conductive shoes.

Work surfaces, carts and containers must be conductive and grounded, use only antistaticpackaging materials. Overall, handling of ESD–sensitive devices should be minimized to prevent damage.

Ohm's and Watt's Laws



E = PRESSURE IN VOLTS

I = CURRENT IN AMPERES

R = RESISTANCE IN OHMS

W = POWER IN WATTS

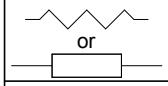
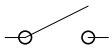
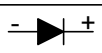
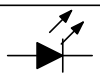
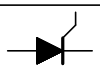
THE DIAGRAM ABOVE SHOWS ALL THE FORMULAS FOR DETERMINING E, I, AND R WITH OHM'S AND WATT'S LAWS.

To find W when E = 10 and R = 5, substitute 10 for E and 5 for R.

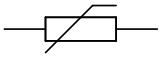
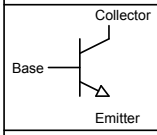
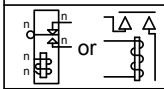
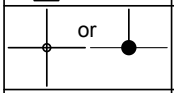
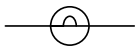
E^2 = 10 x 10 = 100 100 / 5R = 20 WATTS

GENERAL INFORMATION

Glossary (General Definitions and Symbols Used in this Manual)

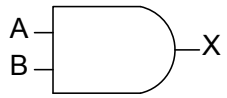
SYMBOL	NOTATION	NAME	VALUES	DESCRIPTION
	A	Amperage	n	Current: effectively the "amount of flow" of electricity.
	V	Volts	n	Electromotive force: effectively the "pressure" of electron movement.
	R	Resistance	n	Opposition to electrom transfer: expressed in OHMS.
	W	Watt	n	A measure of Power. Watts = V*A
	F	Farad	n	Amount of electrical storage in a capacitor.
		BIAS		A voltage used to control or stabilize an electronic circuit. A forward bias is voltage applied in the direction of the current flow within a transistor, tube or circuit. A reverse bias is voltage applied in the opposite direction.
		OCV	n VOLTS	Open Circuit Voltage:
	n	Number		Indicates that any number may be used in its place.
	μ	micro	0.00000n	One Millionth of any unit.
	+	ANODE:		+ Positive element of device.
	-	CATHODE:		- Negative element of device - the banded end of a diode.
	C n	CAPACITOR	μF	Stores energy in the electrostatic field generated between two metal plates separated by an insulator. Typical values are in μF.
	C n	ELECTROLITIC CAPACITOR	μF	Electrolitic capacitors will be damaged if polarity is not correct. Capacitors can charge themselves from ambient electric fields and should be handled with caution.
	R n	RESISTOR	Ω, W	Component that opposes current flow proportionately to its Ohm (W) rating. Power dissapation is expressed in Watts (W).
	F n	FUSE	n A, n V	Device in series with a load which opens the circuit if its current rating (A) is exceeded.
	SW n	SWITCH	n A, n V n P, n T	Device which opens and closes a circuit.
	D n	DIODE		A semi-conductor that conducts in only one direction
	D n	ZENER DIODE		A diode that permits high current flow without damage, the reverse voltage remains almost constant over a wide range of currents, used esp. to regulate voltage.
	D n	LIGHT EMITTING DIODE		Semiconductor diode that emits light when conducting current
	SCR	SILICON CONTROLLED RECTIFIER		Device having primary and secondary inductors for altering a-c signal amplitudes, impedance matching,and isolation purposes. . A reverse blocking triode thyristor
	L n	COIL		Wound wire device; current through the coil generates a electro-magnetic field causing inductive reactance, which increases with number of turns and density.
	L n	COIL (Iron Core)		Adding a core to a coil increases the inductance produced.
	T n	TRANSFORMER		Wound wire device with a primary and secondary coil(s) which increases or decreases voltage applied to the primary based on coil and core configuration. 1:1 transformers are used for isolation.
		GROUND		Identifies the earth (ground) connection. NOTE: Not for a protective earth connection.

Glossary (General Definitions and Symbols Used in this Manual)

SYMBOL	NOTATION	NAME	VALUES	DESCRIPTION
		NEUTRAL		Electronic neutral or common.
		PLUG CONNECTION		Variously configured male/female separable connectors.
	SOL n	SOLENOID		Electro-magnetically operated valve.
	M n	MOTOR	n Ø,HP,V	A device which converts electrical energy to mechanical energy (motion).
		THERMISTOR		A resistor whose resistance changes with temperature.
	T SW n	THERMAL SWITCH		Protective device that protects circuits from over temperature.
	Q n	TRANSISTOR		A transistor amplifies current. A small base current controls the larger collector current.
	TP n	TEST POINT		Dedicated location for obtaining quantification.
	K n	RELAY	n A, n V	Electro-mechanical device for opening / closing a circuit.
		WIRE NODE		Schematic representation of physical connection of wires.
	Y n	CRYSTAL	n MHz	Device using the mechanical resonance of a physical crystal of piezo-electric material to create an electrical signal with a very precise frequency.
		LAMP		Produces light by heating a filament.

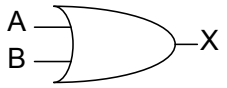
Glossary (General Definitions and Symbols Used in this Manual)

LOGIC SYMBOLS

SYMBOL	NAME	DESCRIPTION
	AND GATE	An AND gate can have two or more inputs. The output of an AND gate is true when all its inputs are true.

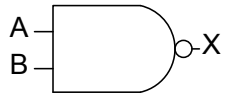
AND

INPUT		OUTPUT
A	B	X = AB
0	0	0
0	1	0
1	0	0
1	1	1

SYMBOL	NAME	DESCRIPTION
	OR GATE	An OR gate can have two or more inputs. The output of an OR gate is true when at least one of its inputs is true.

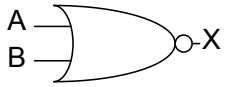
OR

INPUT		OUTPUT
A	B	X = A+B
0	0	0
0	1	1
1	0	1
1	1	1

SYMBOL	NAME	DESCRIPTION
	NAND GATE	A NAND gate can have two or more inputs. The 'o' on the output means 'not' showing that it is a Not AND gate. The output of a NAND gate is true unless all its inputs are true.

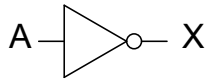
NAND

INPUT		OUTPUT
A	B	$X = \overline{A \circ B}$
0	0	1
0	1	1
1	0	1
1	1	0

SYMBOL	NAME	DESCRIPTION
	NOR GATE	A NOR gate can have two or more inputs. The 'o' on the output means 'not' showing that it is a Not OR gate. The output of a NOR gate is true when none of its inputs are true.

NOR

INPUT		OUTPUT
A	B	$X = \overline{A + B}$
0	0	1
0	1	0
1	0	0
1	1	0

SYMBOL	NAME	DESCRIPTION
	NOT (INVERTER)	A NOT gate can only have one input. The 'o' on the output means 'not'. The output of a NOT gate is the inverse (opposite) of its input, so the output is true when the input is false. A NOT gate is also called an inverter.

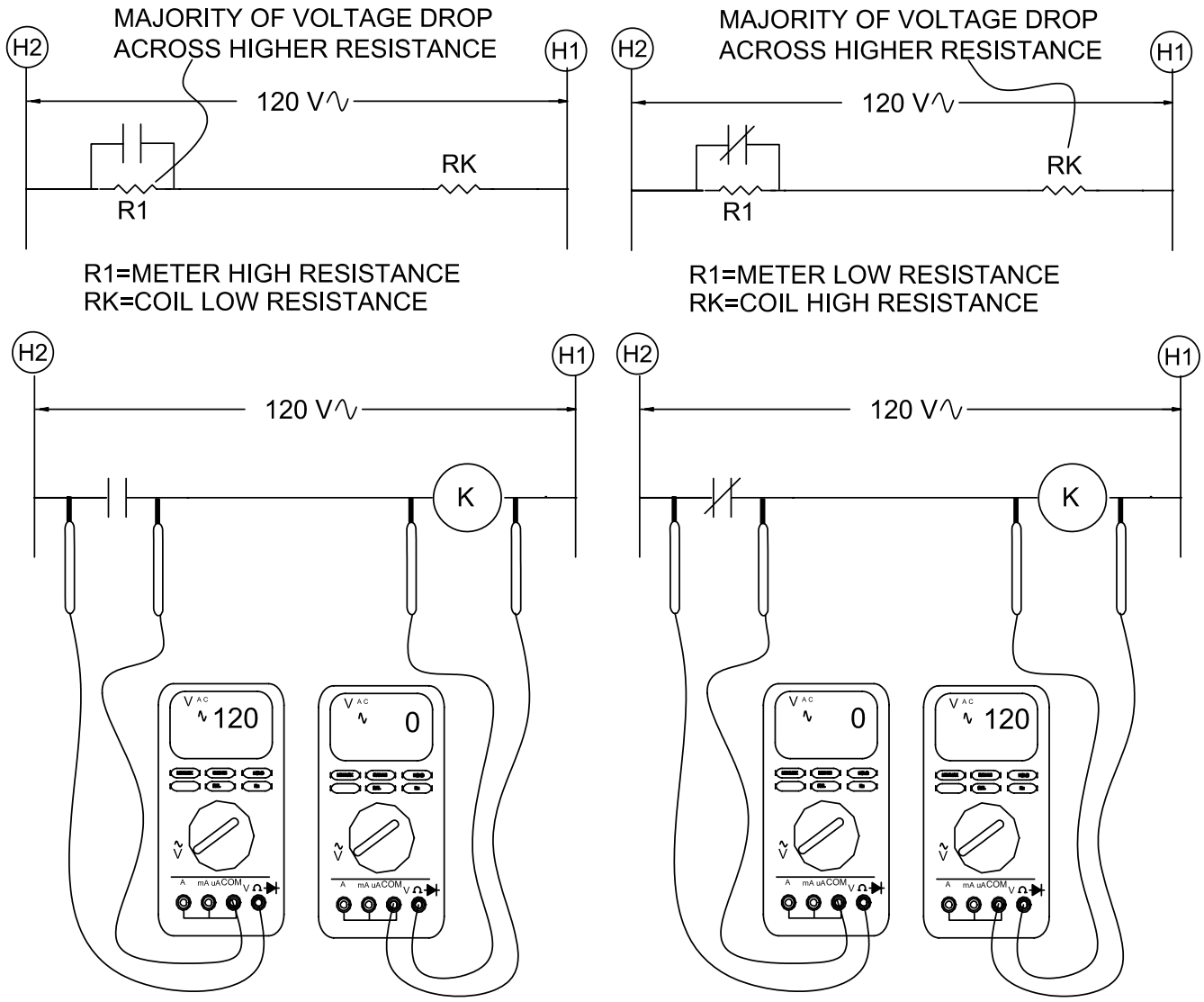
NOT

INPUT	OUTPUT
A	$X = \overline{A}$
0	1
1	0

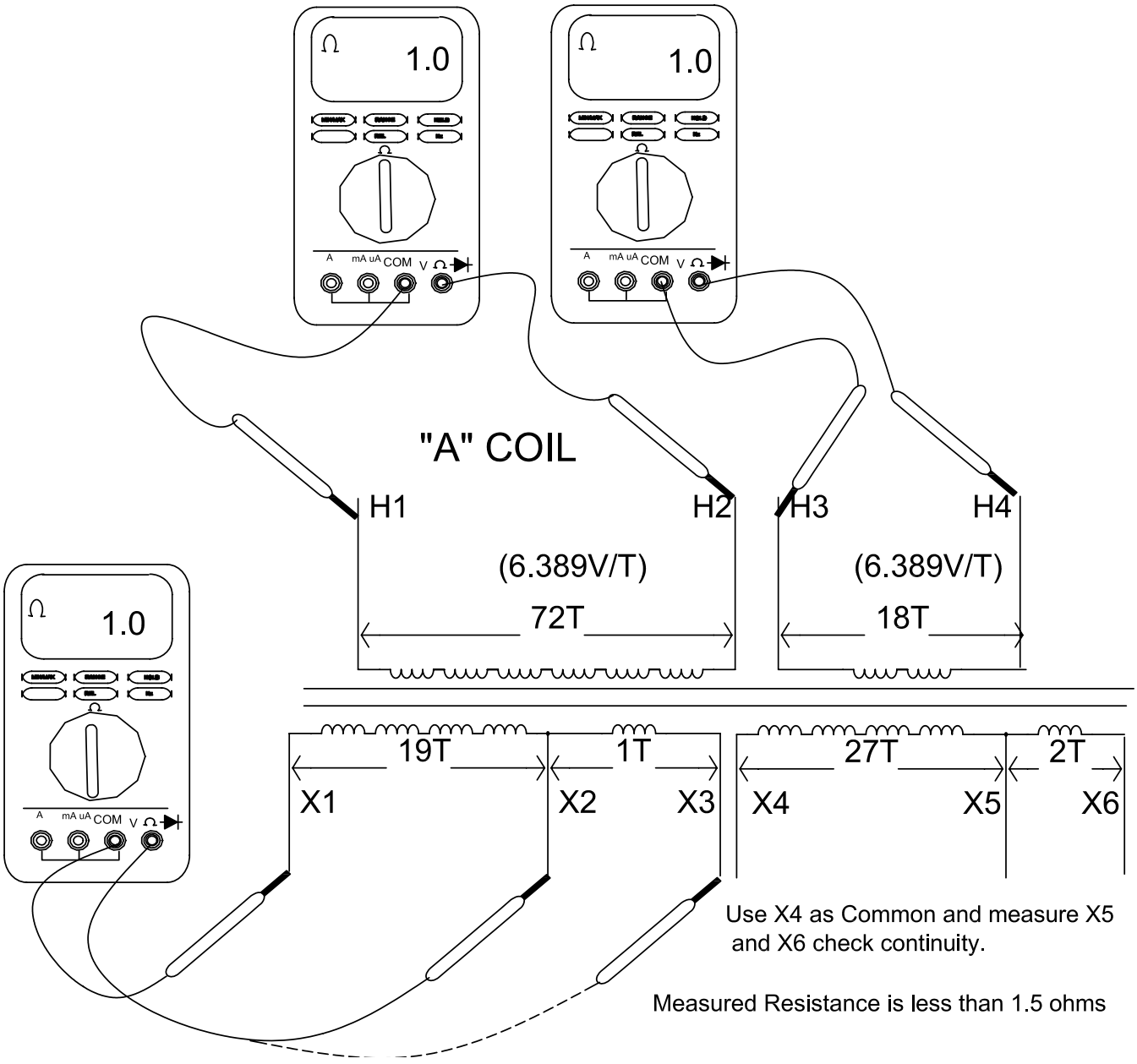
Meter Use

Relay Voltage Drop as a means of voltage in circuit troubleshooting.

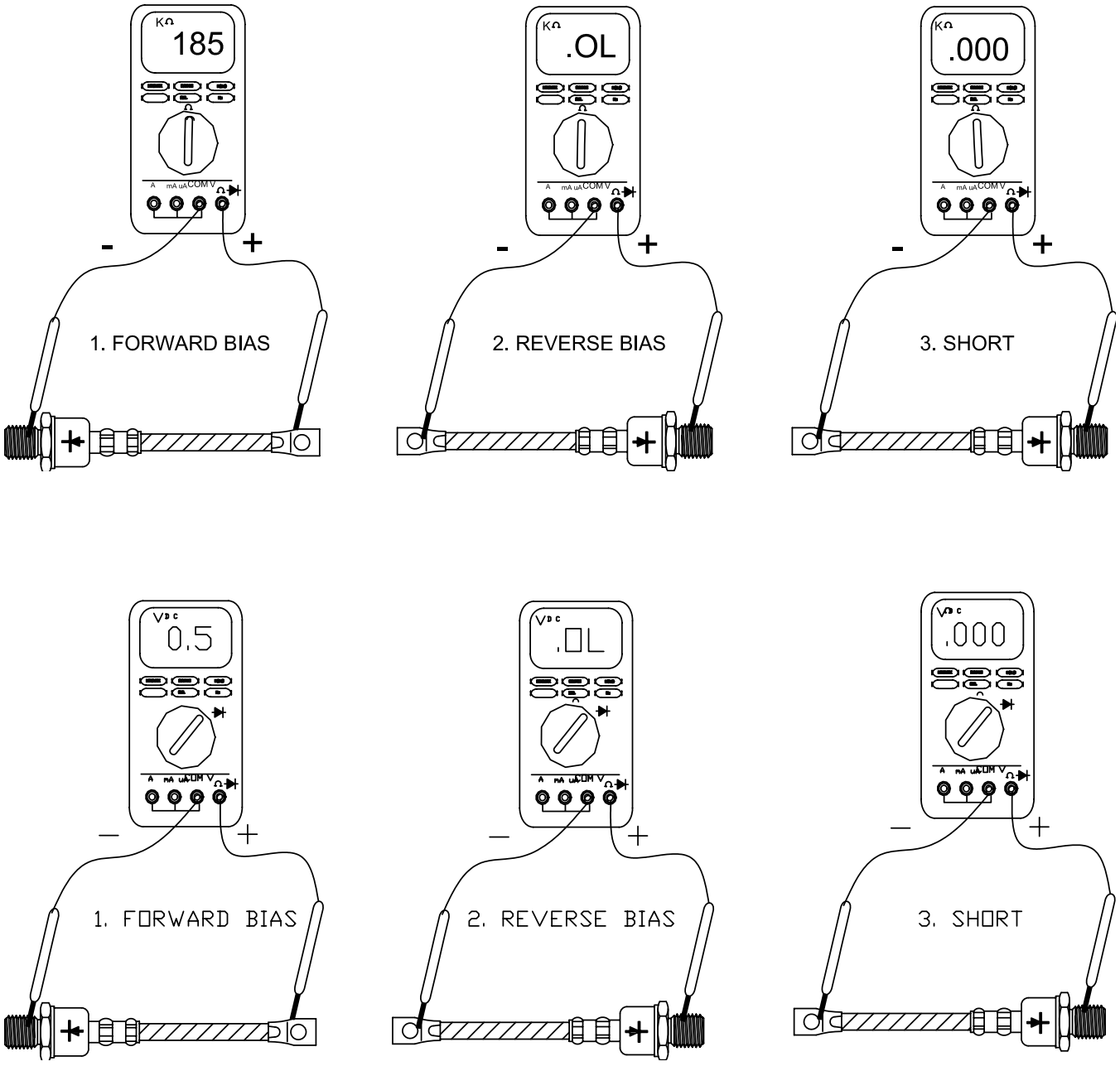
In all series circuits, the total circuit voltage is dropped across the load or electrical devices. The higher the resistance of the load the higher the voltage drop. The lower the load resistance the lower the voltage drop. An open contact in a branch circuit with a load will show a high voltage drop because the meter and the open switch have a very high resistance when compared to the load. While a closed contact that has a meter across, it shows a very low voltage drop since the resistance across the switch is lower than the load. So, using the meter set at the proper voltage range you can test if the contacts are closed or open.



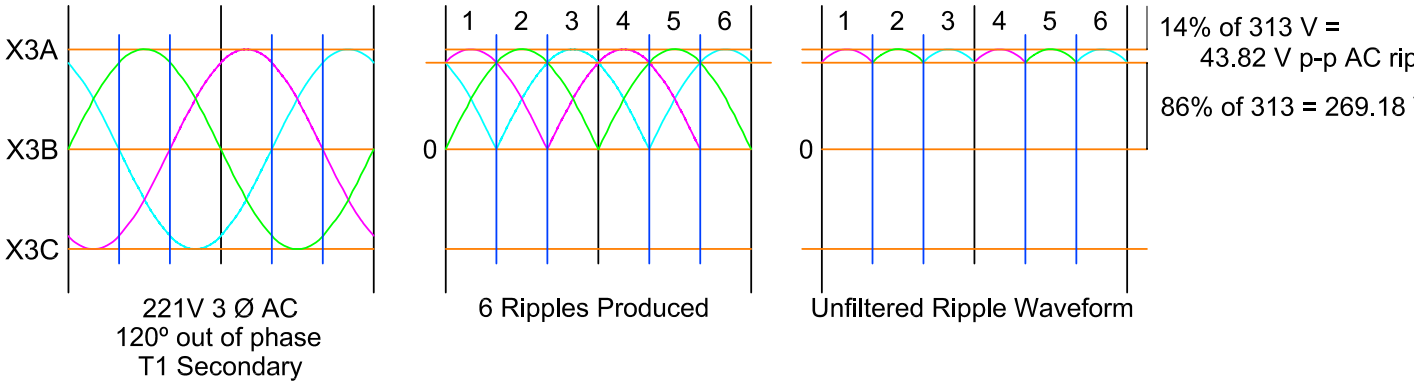
Ohm Testing

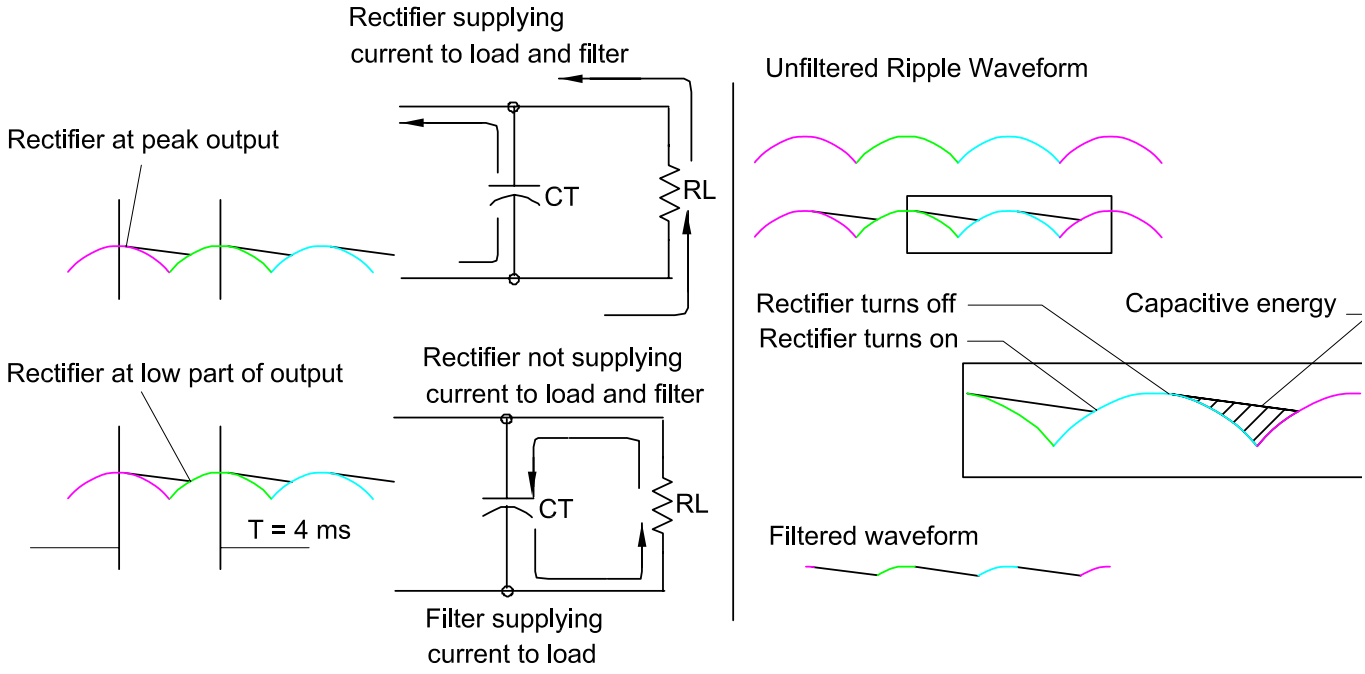

1.0
1.0
1.0
A
mA uA
COM
V
"A" COIL
H1
H2
H3
H4
(6.389V/T)
72T
(6.389V/T)
18T
19T
1T
27T
2T
X1
X2
X3
X4
X5
X6
Use X4 as Common and measure X5
and X6 check continuity.
Measured Resistance is less than 1.5 ohms

Diode Testing



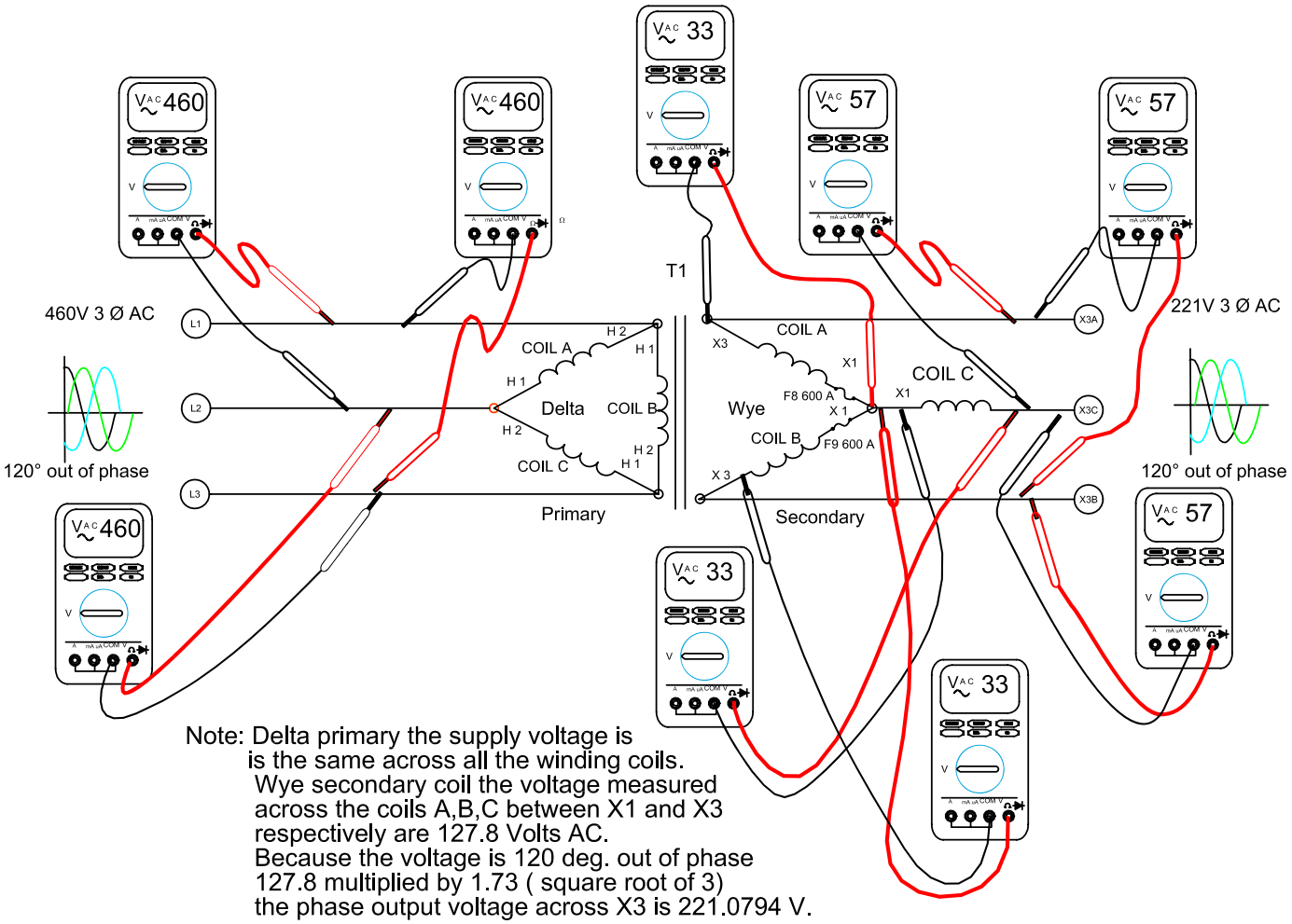
Ripple


X3A
X3B
X3C
221V 3 Ø AC
120º out of phase
T1 Secondary
1 2 3 4 5 6
0
6 Ripples Produced
1 2 3 4 5 6
0
Unfiltered Ripple Waveform
14% of 313 V =
43.82 V p-p AC rip
86% of 313 = 269.18


Rectifier supplying
current to load and filter
Rectifier at peak output
CT
RL
Rectifier at low part of output
T = 4 ms
Rectifier not supplying
current to load and filter
CT
RL
Filter supplying
current to load
Unfiltered Ripple Waveform
Rectifier turns off
Rectifier turns on
Capacitive energy
Filtered waveform

Voltage Measurement

Voltage measurement from the 3 phase AC V Delta primary
and Wye secondary3 phase AC Voutput for the bridge rectifier



Note: Delta primary the supply voltage is
is the same across all the winding coils.
Wye secondary coil the voltage measured
across the coils A,B,C between X1 and X3
respectively are 127.8 Volts AC.
Because the voltage is 120 deg. out of phase
127.8 multiplied by 1.73 (square root of 3)
the phase output voltage across X3 is 221.0794 V.

IGBT Testing

CAUTION

The emitter and the gate of each affected IGBT must be jumpered together to prevent electrostatic damage. Each power source is supplied with six jumper plugs that mate to the IGBT Gate / Emitter Plug.

CAUTION

Electrostatic Discharge Hazard
Electrostatic discharge may damage these components.

- Damage is accumulative and may only appear as shortened component life and not as a catastrophic failure.
- Wear a protective ground strap when handling to prevent damage to PCB components.
- Always place a pc board in a static-free bag when not installed.

REMOVAL:

A. Insure that input power is removed by two actions such as a disconnect switch and removal of fuses. Tag and lock any disconnect switch to prevent accidental activation.
B. Remove the top panel to gain access to the modules located in the top rear of the power source.
C. Clean the compartment containing the modules with dry, oil-free compressed air.
D. Unplug the gate drive leads connecting the IGBT Gates to the PWM/Gate Drive PC Board. In order to prevent damage to the IGBT, install jumper plugs into the IGBT Gate Drive Connector. See Caution below. Jumper plugs are supplied with each power source.
E. Remove the copper bus plates and bars connected to the IGBT's. Save the M6 hardware connecting the bus structure to the module terminals. You may need to re-use the hardware. Longer hardware can damage the module by contacting the circuitry directly below the terminals.
F. Remove the M6 hardware mounting the modules to the heat sink. Save the hardware because you may need to re-use it. Hardware too short can strip the threads in the Aluminum heat sink. Hardware too long can hit the bottom of the holes causing the modules to have insufficient thermal contact to the heat sink. Hardware too long or too short can cause module damage due to over heating.

CAUTION

The module gate plugs must be plugged into the PWM/Gate Drive PC Board whenever the power source is in operation. Failure to plug them in will result in damage to the module and possible damage to the torch.

IGBT REPLACEMENT

REPLACEMENT:

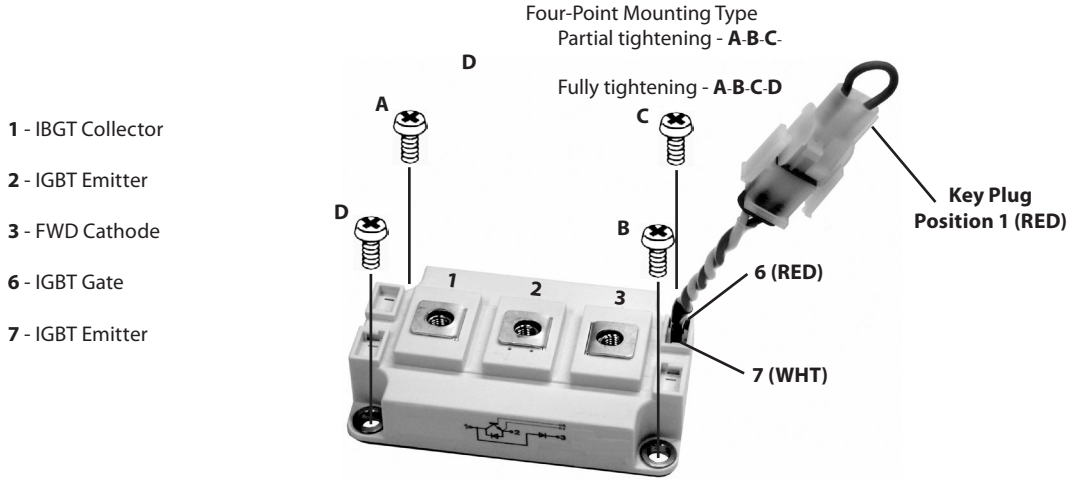
A. Thoroughly clean any thermal compound from the heat sink and the modules. Any foreign material trapped between the module and heat sink, other than an appropriate thermal interface, can cause module damage due to over heating.
B. Inspect the thermal (interface) pad, P/N 951833, for damage. A crease or deformity can prevent the module from seating properly, impeding the heat transfer from the module to the heat sink. The result can be module damage due to over heating.

If a thermal pad is not available, a heat sink compound such as Dow Corning® 340 Heat Sink Compound may be used. It's a good idea to mount all paralleled modules located on the same heat sink using the same thermal interface. Different interfaces can cause the modules to operate at different temperatures resulting in un-equal current sharing. The imbalance can shorten module life.

C. Place a thermal pad, and an IGBT module on the heat sink. Carefully align the holes in the thermal pad with the heatsink and module holes. If heat sink compound is used in place of a thermal pad, apply a thin coat of even thickness to the metal bottom of the module. A thickness of 0.002" – 0.003" (0.050mm – 0.075mm) is optimum. Too much compound impedes heat transfer from the module to the heat sink resulting in short module life due to over heating.
D. Insert the four M6 mounting bolts, but do not tighten. Leave them loose a few turns. Be certain that the threads from the mounting bolts do not bend the edges of the thermal pad clearance holes. A bent thermal pad can prevent the module from seating properly, impeding the heat transfer from the module to the heat sink. The result can be module damage due to over heating.
E. Partially tighten the four mounting bolts a little more than finger tight in the order: A-B-C-D. See figure below.
F. Fully tighten, in the same order above, to a torque of 35 – 44 in-lbs (4.0 – 5.0 N-M). See figure below.
G. Install the bus plates and bus bars. Be careful that the sheets of insulation separating the bus plates are still in their original positions. It's a good idea to tighten the mounting hardware only after getting it all started. Torque the M6 module terminal hardware to 35 – 44 in-lbs (4.0 – 5.0 N-M).
H. Remove the jumper plugs from the module gate lead plugs, and plug into the appropriate plugs from the PWM/Gate Drive PC Board. See Caution below.
I. Replace the top panel.

CAUTION

The module gate plugs must be plugged into the PWM/Gate Drive PC Board whenever the power source is in operation. Failure to plug them in will result in damage to the module and possible damage to the torch.



IGBT Assembly Testing (0558006183)

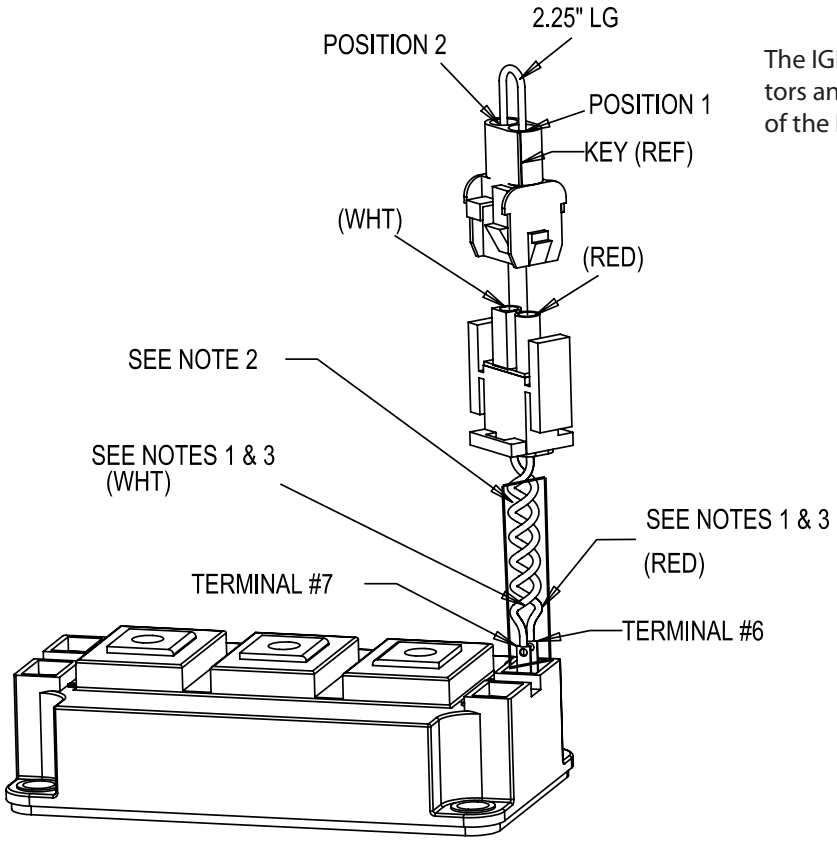
This assembly consists of 4 ea., 400A, 1200V IGBTs that combine the simple gate drive characteristics of the MOSFET with the high current and low saturation voltage capability of BJTs by combining an isolated gate FET for the control input, and a bipolar power transistor as a switch, in a single device.

When on, these IGBTs allow current to flow to the electrode.

Test:
With the IGBT disconnected and your meter in the diode scale, check the internal diodes by making connections found in the table listed below.

IGBT Test (Meter in Diode Scale)		
Probe(+)	**Probe(-)**	**Reading**
2	1	0.7
1	3	0.7

Reverse the leads across the bipolar power transistor. Connect the black lead to 2 and the red lead to 1. Now, "gate on" the IGBT by connecting a 9V battery to G2 and E2 of the IGBT. In the diode scale, your meter's reading should change from OL to 0.7 when the IGBT has been "gated on". Reverse the battery leads to gate the IGBT off.



USE WITH P/N 951833, THERMAL PAD.

The IGBT Assembly consists of all wire, connectors and tubing needed for proper connection of the IGBT module.

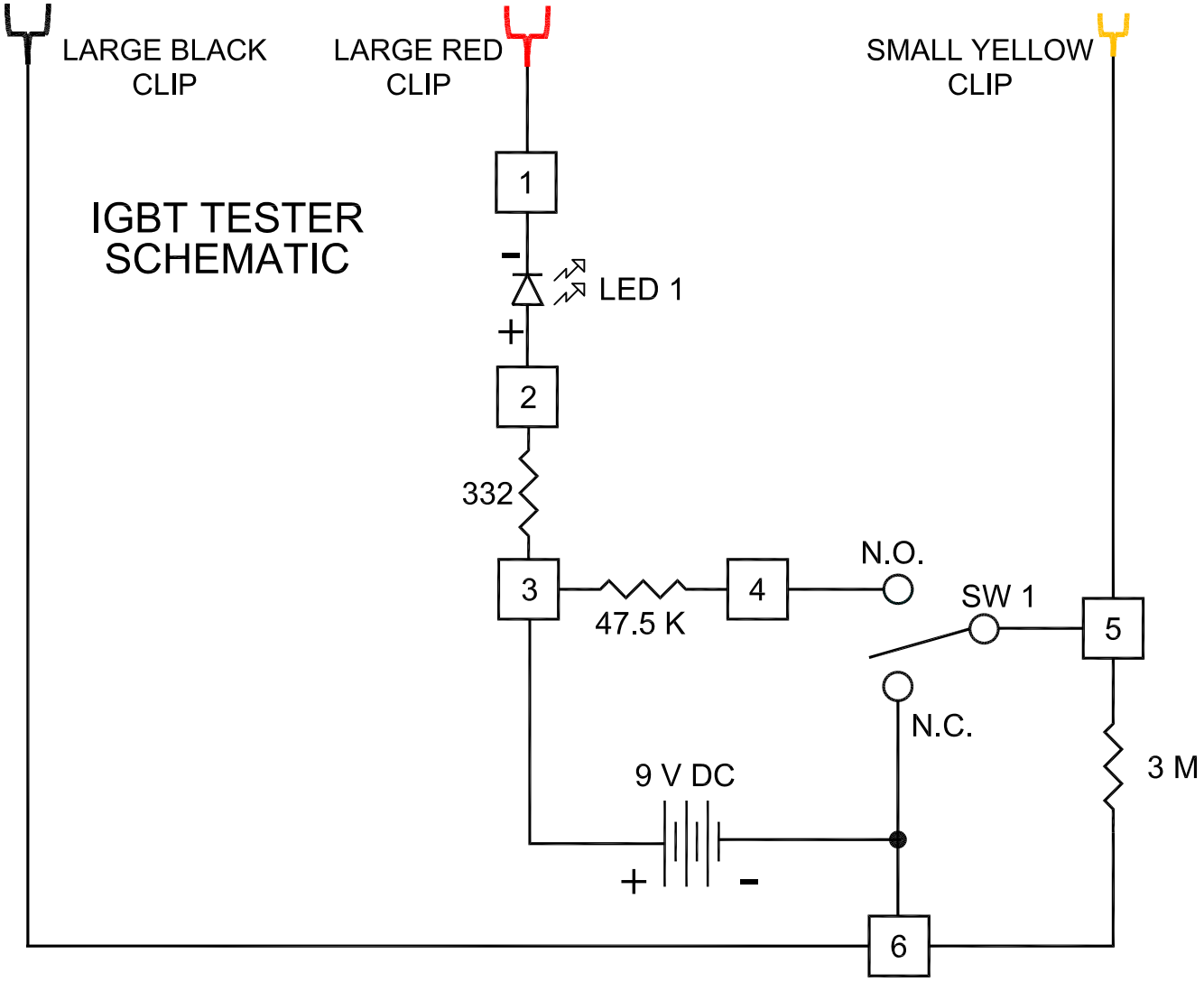
NOTES:
1. APPLY HEAT SHRINK TUBING (ITEM 10) TO COVER SOLDER JOINT AND THE GATE TERMINAL, #6, AND THE EMITTER TERMINAL, #7.

2. TWIST RED AND WHT WIRES TOGETHER FORMING A MINIMUM OF 2 1/2 AND A MAXIMUM OF 4 1/2 TWISTS.

3. CUT RED AND WHITE WIRES USED IN TWISTED PAIR TO 4.5" MEASURED BEFORE TERMINATING AND TWISTING.

4. PERFORM ASSEMBLY AT STATIC SAFE STATION: SURFACE MAT, WRIST STRAP & GROUNDED SOLDERING IRON.

IGBT Testing



Appendix

1. ***Appendix A: Machine schematics***
2. ***Appendix B: Control Board (PCB1) schematics***
3. ***Appendix C: Driver Board (PCB2) schematics***
4. ***Appendix D: Wiring Diagrams***
5. ***Appendix E: Connectors Information***
6. ***Appendix F: Replacement Parts***

NOTES

REVISION HISTORY

1. Originally released -08/2013
2. Revision 10/2013 - help codes
3. Revision 04/2014- added Interface Adaptor Box to optional accessories, not to be added to translations.
4. revision 06/2014 - updated helpcodes, updated BOM.

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